

SBW CONSULTING, INC.

Report 0804

**2008 FIRST VERIFICATION REPORT
MAJOR COMMERCIAL CONTRACT GROUP**

Submitted to

CALIFORNIA PUBLIC UTILITIES COMMISSION

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1. EXECUTIVE SUMMARY

The California Public Utilities Commission (CPUC) Energy Division (ED) has been charged with conducting evaluation, measurement and verification (EM&V) of the 2006-2008 energy efficiency programs. To properly manage the required EM&V activities for a large number of programs in a timely manner, the CPUC segmented the programs into ten discrete groups (referred to as Contract Groups). One of the ten contract groups, called the Major Commercial group, includes six commercial, industrial and agricultural (CIA) programs being implemented by Southern California Edison (SCE), Southern California Gas (SCG) and San Diego Gas and Electric (SDGE). The Major Commercial contract group was identified by ED as one of the five contract groups that require a first and second verification report² because four of the programs in this contract group account for a significant portion of the 2006-07 savings claim for these three utilities. This first verification report documents the procedures and results obtained from the first year (2006/07) verification effort.

1.1. Purpose and Approach

The primary purpose of the EM&V is to increase the quality, reliability and objectiveness of the estimated impacts of the energy efficiency programs. Information from the evaluation will be used to improve the effectiveness of acquiring energy efficiency for the IOU ratepayers. It will also be used as the basis for payment of earnings to the IOUs. Utility reported measure installations and verification of these installations provide the basis for the payment of earnings to the IOUs.

The CPUC's recent decision in this matter permits IOUs to file interim earning claims in both September of 2008 and 2009. These earnings claims are to be based on ED Verification Reports of Costs and Installations and Services Completed ("Verification Reports"), for the years 2006-2007 and 2006-2008 respectively, to be released in August, 2008. In turn, these two ED Verification Reports (2008 and 2009) are based on the ED's aggregation of all 1st Final Verification Reports. In March of 2010, ED is required to submit to the Commission a Final Verification and Performance Basis Report that will serve as the basis for IOUs final earnings claims, and which will include a "true-up" from prior interim claims. This ED final report is based on evaluator's Final Evaluation Reports, due to Energy Division in February, 2010.

1.1.1. Programs Included in the Major Commercial PY2006/07 Verification Study

The MECT³ reviewed program-specific data obtained from the IOU quarterly reports for the period of January 1, 2006 through June 30, 2007 and identified high-impact combinations that are the focus of the first verification study. They produced tables that showed for each utility portfolio, the high-impact combinations that accounted for approximately 85% of the kWh, kW, and therm savings. These tables revealed that five of the ten contract groups have high impact combinations for this time period. The

² The first verification report covers program years 2006 and 2007. The second verification report covers program year 2008.

³ MECT is the Master Evaluation Contract Team, responsible for giving technical assistance to the Energy Division Contract Managers.

Major Commercial contract group was one of these groups. The MECT analysis showed that high impact combinations were found in four of the six programs within the Major Commercial contract group. The MECT analysis was reviewed by the evaluation contractor and found to be reasonable.

A description of the four affected programs and the high impact combinations identified within each of the programs is provided below:

Business Incentives and Services Program (SCE2517). This program, implemented by SCE, is an integration of three previously stand-alone programs: Standard Performance Contract, Express Efficiency and Non-residential Audits. The integrated package of programs offers a full range of energy efficiency choices to all commercial, industrial and agricultural customers, regardless of size, who pay the public goods charge. This program provides incentives for high impact measure groups such as interior lighting, motor controls, industrial process and refrigeration.

Business Energy Efficiency Program (SCG3513). This is a local non-residential energy efficiency incentive program, implemented by SCG, which targets all nonresidential customers, including commercial, industrial and agricultural customers within the SCG service area. It is a new program for the 2006-08 cycle. The program currently consists of four program elements that meet the diverse needs of its non-residential gas customers. This program provides incentives for a variety of large customized measures.

Standard Performance Contract Program (SDGE3025). The Standard Performance Contract (SPC) Program is a statewide non-residential energy efficiency incentive program. SPC offers financial incentives for the implementation of electric or gas energy efficiency projects. The program accommodates nearly all energy efficiency measures in commercial, industrial and agricultural facilities within the SDGE service area. This program provides incentives for high impact measure groups such as interior lighting and cooling.

Energy Savings Bid Program (SDGE3010). The Energy Savings Bid (ESB) Program is a local non-residential energy efficiency incentive program that is designed for large commercial or industrial efficiency projects that require more flexibility than is offered by the statewide Standard Performance Contract (SPC) program. This program provides incentives for high impact measure groups such as interior lighting, cooling, HVAC controls and a variety of other large customized measures.

1.1.2. Overview of Approach

A verification plan was written to describe a complete set of data collection, data analysis and reporting procedures necessary to prepare the verification report. Important aspects of these procedures are summarized below.

Verification Sample Selection. For the first verification report, a sample of paid measures was drawn to represent measures paid by the programs in the contract group through December 31, 2007. Measures in high-impact groups defined by MECT were represented in this sample in approximately the same proportions found in the population.

On-Site Data Collection. An on-site survey was performed to document the count of equipment installed and its eligibility and current operational status for sampled measures, and to verify the measure cost. The survey also collected information necessary to confirm the DEER ID or work paper ID (if applicable) and savings, and verify the project cost.

Review Ex Ante Savings Estimates. The verification of each measure also included an assessment of the ex-ante savings estimate prepared by the IOUs. The ex-ante estimates came from one of three sources – a custom analysis of the measure savings (documented in the application file), work papers developed by the IOUs or the DEER⁴ database. For DEER and work paper measures in the SCE Express program, the IDs and savings assigned by the IOU were reviewed and independently verified using data collected at the site. In cases where the verified ID and/or savings differed from the IOU assigned ID and savings, an attempt was made to determine the reasons for the discrepancy.

For the remaining programs, where the IOU savings estimate was based on a custom analysis, a more rigorous examination of the savings estimate was made. If the review resulted in concerns or issues related to the savings algorithm used or its application to the sampled measure, note was made in the verification database for further consideration in the full-evaluation. A re-calculation of energy savings was not made as part of the verification study.

1.2. Verification Sample Design and Selection

Samples were drawn, using stratified random sampling methods, to represent each program's high impact measures. For SDGE3010, two separate samples were drawn, one to represent electric savings and another to represent gas savings. The samples were stratified by the ex ante estimate of measure savings. The distribution of measure savings was examined to determine optimum boundaries for each strata. The relative variance across the strata was examined to determine what portion of the sample would be allocated to each strata. The strata boundaries and sample allocations were determined using methods consistent with those documented in Chapters 4 and 5 of *Sampling Technique*, Cochran, 3rd Edition. This stratified sample design improved sampling efficiency and maximized the precision of the results.

Across all five program-fuel domains, 116 measures were selected. Data collection and analysis was completed for all sampled measures.

1.3. Verification Rates for Sampled Measures

Verification rates were calculated for each of the 116 sampled high impact measures. A verification rate of one was calculated when the verification quantity, total savings and unit savings (SCE2517 Express Efficiency only) equaled the ex ante value. When difference occurred, the verification rate could be greater than or less than one. A verification rate other than one was calculated for 26 of the 116 sampled

⁴ DEER (Database for Energy Efficient Resources) is a CEC and CPUC sponsored database designed to provide well-documented estimates of energy and peak demand savings values, measure costs, and effective useful life within one data source.

high impact measures (22%). For four measures the calculated verification rate was greater than one. For the remaining 22 measures the calculated verification rate was less than one. The verification rates for the individual measures ranged from a high of 1.31 to a low of zero (program measure was replaced). The verification rates for one measure was reduced somewhat because the verification determined that the total ex ante savings value in the IOU database was not consistent with the application file.

Table ES-1 Summary of Verification Rates for Sampled Measures

| Program | Measure Group | Savings (ex ante) | | | Verification Rate | | |
|--------------|-----------------------|-------------------|----------|---------|-------------------|-------|--------|
| | | kW | kWh | therms | kW | kWh | therms |
| SCE2517kWh | C&I Interior lighting | 1351 | 8624578 | 0 | 0.940 | 0.874 | |
| | C&I Mtr controls | 1256 | 18305114 | 0 | 0.998 | 0.987 | |
| | C&I Other | 4884 | 45825702 | 0 | 1.000 | 1.000 | |
| | C&I Process | 1151 | 10322160 | 0 | 1.000 | 1.000 | |
| | C&I Refrigeration | 34 | 319165 | 0 | | 0.600 | |
| SCG3513Therm | C&I Other | 0 | 0 | 6410840 | | | 0.955 |
| SDGE3010kWh | C&I Cooling | 133 | 1020659 | 0 | 1.000 | 1.000 | |
| | C&I HVAC Controls | 794 | 13273249 | 0 | 0.997 | 0.997 | |
| | C&I Interior lighting | 412 | 2455232 | 0 | 0.999 | 0.999 | |
| | C&I Other | 381 | 3482581 | 121694 | 1.000 | 1.000 | 1.000 |
| Therm | C&I Other | 383 | 3972746 | 1043123 | 1.000 | 1.000 | 1.000 |
| SDGE3025kWh | C&I Cooling | 345 | 2430637 | 0 | 1.000 | 1.000 | |
| | C&I Interior lighting | 214 | 1029401 | 0 | 0.934 | 0.934 | |

Table ES-1 provides a summary of the calculated verification rates by measure group within program. The table shows a verification rate of one or close to one for most of the program/measure group combinations. The lowest verification rate of 0.60 is observed for the C&I Refrigeration measure group in the SCE2517 program. Although this rate is relatively low, it has a minor impact on the verification rate for the entire SCE2517 program because this measure group accounts for a very small portion (less than 1%) of the SCE2517 total ex ante savings. A C&I Interior Lighting kWh verification rate of 0.874 (SCE2517 program) is noted as the next lowest value. Verification rates of 0.90 or above are observed for all other program/measure group combinations.

1.4. Program-level Verification Rates

To produce program-level verification rates for the high impact measures, individual verification rates for the sampled high impact measures were weighted by the size of their respective kWh or therm impacts and by the proportion of the total program impacts represented by each stratum. Seven different strata were used. Stratum 9 is always the certainty strata and stratum 8 is always the excluded cases (very small savers). The definitions for strata one through five is unique to each program fuel domain. They are defined by ranges of ex ante savings, with strata 1 having the smallest average measure savings and the strata 5 the largest.

The verification rates by stratum, as well as the program-level verification rate and the associated confidence interval for program SCE2517 are shown in Table ES-2a. The program-level verification rate for kW and kWh is 0.94 and 0.93, with a relative precision of 11% and 12% respectively, at the 90 percent confidence level. Similar information for program SCG3513 is provided in Table ES-2b. The program-level verification rate for therms is 0.96, with a relative precision of 21% at the 90 percent confidence level. The program-level verification rate for the SDGE3010 program is 1 for electric and gas, as shown in Table ES-2c. The variance of the electric and gas samples is zero so a relative precision and confidence level could not be estimated. The program-level verification rates for program SDGE3025 is shown in Table ES-2d. The table shows kW and kWh verification rates of 0.94 and 0.95, respectively. A relative precision of 9% and 6% at the 90 percent confidence level were calculated for kW and kWh, respectively.

Table ES-2a Program-level Verification Rates for SCE2517 by Strata

| SCE2517 Strata | Verification Rate | | |
|-------------------|-------------------|--------------|--------|
| | kW | kWh | therms |
| 1 | 0.96 | 0.85 | |
| 2 | 0.91 | 0.92 | |
| 3 | 0.92 | 0.88 | |
| 4 | 0.94 | 0.94 | |
| 5 | 1.00 | 1.00 | |
| 9 | 1.00 | 1.00 | |
| Weighted VR | 0.94 | 0.93 | |
| 90 Percent CI | 0.84 to 1.05 | 0.82 to 1.05 | |
| N | 47 | 47 | |

Table ES-2b Program-level Verification Rates for SCG3513 by Strata

| SCG3513 Strata | Verification Rate |
|-------------------|-------------------|
| | therms |
| 1 | 0.79 |

| SCG3513 Strata | Verification Rate |
|-------------------|-------------------|
| | therms |
| 2 | 0.99 |
| 9 | 1.00 |
| Weighted VR | 0.96 |
| 90 Percent CI | 0.76 to 1.16 |
| N | 25 |

Table ES-2c Program-level Verification Rates for SDGE3010 by Strata

| SDGE3010 Strata | Verification Rate | | |
|--------------------|-------------------|----------------|--------|
| | kW | kWh | therms |
| 1 | 1.00 | 1.00 | 1.00 |
| 2 | 1.00 | 1.00 | |
| 3 | 1.00 | 1.00 | |
| 4 | 1.00 | 1.00 | |
| 5 | 0.99 | 0.99 | |
| 9 | 1.00 | 1.00 | 1.00 |
| Weighted VR | 0.998 to 1 | 0.998 to 0.998 | 1.00 |
| 90 Percent CI | 0.00 | 0.00 | |
| N | 25 | 25 | 5 |

Table ES-2d Program-level Verification Rates for SDGE3025 by Strata

| SDGE3025 Strata | Verification Rate | |
|--------------------|-------------------|-------------|
| | kW | kWh |
| 1 | 0.96 | 0.96 |
| 2 | 0.86 | 0.89 |
| 3 | 0.98 | 0.99 |
| 9 | 1.00 | 1.00 |
| Weighted VR | 0.94 | 0.95 |
| 90 Percent CI | 0.86 to 1.02 | 0.9 to 1.01 |
| N | 14 | 14 |

1.5. Conclusions

From the results of the first year verification analysis the following key conclusions are drawn:

1. Verification rates for sampled measures – a verification rate of 1 (verification equal to ex ante) was computed for 90 of the 116 sampled measures (78%). For four measures the verification rate was greater than one. For the remaining 22 measures, the verification rate was calculated to be less than one. The primary reason cited for verification rates other than one was the verification observed quantity being less than the ex ante quantity. Other primary reasons were the incorrect assigned IDs or incorrect assigned unit savings values for DEER or workpaper measures in the SCE2517 Efficiency Express program.
2. Program level verification rates – the program level verification rates for kWh ranged from a low of 0.93 for SCE2517 to a high of 1.0 for SDGE3010. Program level verification rates for therms ranged from a low of 0.96 for SCG3513 to 1.0 for SDGE3010.
3. Unit savings for SCE2517 Express Efficiency – for 80 percent of the Express Efficiency measures that were included in the sample, the verification unit savings value differed from the ex ante unit savings value. The difference ranged across measures from a 31% increase in the savings from the verification to an 83% decrease in savings. In all cases the differences were caused by either the assignment of the wrong ID (DEER or work paper) or the assignment of the wrong unit savings for a correct ID. A discussion with SCE about these results indicated that the wrong assignments were due to a problem with the IOU tracking database, which is being corrected.

2. PURPOSE AND APPROACH

2.1. Background

The California Investor Owned Utilities (IOUs) offer a wide variety of energy conservation programs to their residential and non-residential customers. The current programs are being implemented by the utilities and third parties in a 3-year cycle for the years 2006 through 2008. The California Public Utilities Commission (CPUC) Energy Division (ED) has been charged with conducting evaluation, measurement and verification (EM&V) of the 2006-2008 energy efficiency programs. The primary purpose of the EM&V is to increase the quality, reliability and objectiveness of the estimated impacts of the energy efficiency programs. Information from the evaluation will be used to improve the effectiveness of acquiring energy efficiency for the IOU ratepayers. It will also be used as the basis for payment of earnings to the IOUs.

To properly manage the required EM&V activities for a large number of programs in a timely manner, the CPUC segmented the programs into ten discrete groups (referred to as Contract Groups). One of the ten contract groups, called the Major Commercial group, includes six commercial, industrial and agricultural (CIA) programs being implemented by Southern California Edison (SCE), Southern California Gas (SCG) and San Diego Gas and Electric (SDGE). The Major Commercial contract group was identified by ED as one of the five contract groups that require a first and second verification report because four of the programs in this contract group account for a significant portion of the 2006-07 savings claim for these three utilities. This first verification report documents the procedures and results obtained from the first year (2006/07) verification effort.

2.2. Purpose and Focus of First Verification Report

Utility reported measure installations, along with verification of these installations, provide the basis for the payment of earnings to the IOUs. The CPUC's recent decision in this matter permits IOUs to file interim earning claims in both September of 2008 and 2009. These earnings claims are to be based on ED Verification Reports of Costs and Installations and Services Completed ("Verification Reports"), for the years 2006-2007 and 2006-2008 respectively, to be released in August, 2008. In turn, these two ED Verification Reports (2008 and 2009) are based on the ED's aggregation of all 1st Final Verification Reports. In March of 2010, ED is required to submit to the Commission a Final Verification and Performance Basis Report that will serve as the basis for IOUs final earnings claims, and which will include a "true-up" from prior interim claims. This ED final report is based on evaluator's Final Evaluation Reports, due to Energy Division in February, 2010.

The implication of CPUC decisions on the requirements for the verification reports is twofold. First, The Commission clearly states that ED's 2008 and 2009 Verification Reports shall "serve to verify the number of measure installations and portfolio and program costs." Reporting by utility portfolio is mandated and while reporting by utility program is desirable to inform program implementers, it is not, however, required for ED reporting purposes. Second, the Commission has provided ED flexibility to determine the exact approach that it may direct evaluation contractors to use, both regarding preparation of Verification Reports for 2008 and 2009, and for preparation of the 2010 Final Evaluation Report.

Based on the CPUC decisions, ED has elected to focus work on the 2008 first verification reports on the verification of high-impact measure and program combinations within each utility's portfolio as identified by utility 2006-2007 reporting and tracking data bases. Review of initial utility-reported data for 2006 indicates that a range of 6 to 16 measure and program combinations account for approximately a 85 to 90% range of total utility-reported annual energy and demand savings. This clustering of reported utility annual energy and demand savings around a relatively small number of measure and program combinations suggested that a coordinated approach across contract groups would provide robust results at the utility portfolio level in the most cost effective manner.

2.3. Programs Included in the Major Commercial PY2006/07 Verification Study

The MECT reviewed program-specific data obtained from the IOU quarterly reports for the period of January 1, 2006 through June 30, 2007 and identified high-impact combinations that are the focus of the first verification study. For each utility, the MECT first mapped individual measures into measure group and program combinations. Next, for each utility, the MECT ranked the measure group and program combinations by the magnitude of their total kWh, kW, and therms. Savings for each combination were summed in rank order until the cumulative savings represented at least 85% of a utility's claimed savings for kWh, kW, and therms. The combinations are referred to as high-impact combinations. Both PG&E and SDG&E have goals for kWh, kW, and therms. SCE has goals for kWh and kW while SoCal Gas has only a therms goal. Samples for the first verification study were drawn to support the earning claims for each utility for each of its energy and demand goals.

The MECT produced tables that showed for each utility portfolio, the high-impact combinations that accounted for approximately 85% of the kWh, kW, and therm savings. These tables revealed that five of the ten contract groups have high impact combinations for this time period. The Major Commercial contract group was one of these groups. The MECT analysis showed that high impact combinations were found in four of the six programs within the Major Commercial contract group. The MECT analysis was reviewed by the evaluation contractor and found to be reasonable.

A description of the four affected programs and the high impact combinations identified within each of the programs is provided below:

BUSINESS INCENTIVES AND SERVICES PROGRAM (SCE2517). This program, implemented by SCE, is an integration of three previously stand-alone programs: Standard Performance Contract, Express Efficiency and Non-residential Audits. The integrated package of programs offers a full range of solutions to all commercial, industrial and agricultural customers, regardless of size, who pay the public goods charge.

The Standard Performance Contract program is a statewide program that offers cash incentives for the installation of high efficiency equipment or systems. Incentives are based on annual kWh savings and paid upon completion and inspection of the project. All non-residential customers are eligible to participate and all projects require both a pre and post installation inspection. Projects are typically customized equipment or systems for commercial, industrial or agriculture facilities that fall outside the incentive programs that offer rebates for a prescriptive group of measures.

Express Efficiency is a statewide program that provides itemized energy efficiency measures to all nonresidential customers on a seamless statewide basis. Offering itemized measures and a simplified process for customers to apply for and receive a prescribed rebate makes it attractive for firms to invest in energy efficiency in the short term in order to lower energy costs in the long term.

The Non-residential Audits is a local program that delivers energy efficiency information and awareness to business customers, which often results in participation in energy efficiency projects. Business Incentives & Services (BIS) audits are conducted on-site at the customer facility by qualified SCE staff. For small sites, measures are analyzed during the audit with a hand-help PDA that runs standardized software to estimate annual savings (kWh and kW). A more in-depth audit is performed for the medium and large sites, that includes the identification and analysis of customized, site-specific measures. Both levels of audits recommend that the customers apply to Express or SPC to receive incentives for the recommended measures that they implement.

This program provides incentives for high impact measure groups such as interior lighting, motor controls, industrial process and refrigeration.

BUSINESS ENERGY EFFICIENCY PROGRAM (SCG3513). This is a local non-residential energy efficiency incentive program, implemented by SCG, that targets all nonresidential customers, including commercial, industrial and agricultural customers within the SCG service area. It is a new program for the 2006-08 cycle. The program currently consists of four program elements:

1. **Process Equipment Replacement (PER)** - This program element provides incentives to qualified customers for installing new energy-efficient equipment. To qualify for the incentives, customers must contact SCG or their account executive prior to purchasing the installing the qualifying equipment. Efficiency measures may include but are not limited to replacements or improvements to:
 - Furnace Replacement
 - Misc Process Equipment Replacement
 - Kiln Replacement
 - Equip Modernization and Conservation
 - Oven Replacement
 - Engine Rebuild/Replacement
 - Heat Recovery
 - Pump Rebuild/Replacement
2. **Custom Process Improvement (CPI)** – This program element provides incentives to implement comprehensive energy efficient processes. To qualify for the incentives, customers must contact SCG or their account executive prior to purchasing the installing the qualifying equipment. The qualifying measures are similar to the list shown for process equipment replacement above.

3. **Commercial Food Service Rebate Program** – This program element offers rebates to qualified customers on qualified food service and commercial/industrial equipment. To qualify for the rebate, customers must purchase and install the qualifying equipment before they submit the application. Equipment must meet technical requirements specified on the application form.
4. **Energy Efficiency Grant Program (EEGP)** – This program element targets projects that save more than 250,000 therms per year. It is designed to encourage very large nonresidential customers to develop and submit innovative and varied strategies to reduce gas usage at their facilities. A measurement and verification approach is used to determine the energy savings and applicable incentive. There are no pre-determined measures for the grant program.

Participants are guided into the program through multiple channels such as audits, energy efficiency training and education seminars, the commercial support center, account executives and commercial/industrial service technicians. This program provides incentives for a variety of large customized measures.

ENERGY SAVINGS BID PROGRAM (SDGE3010). The Energy Savings Bid (ESB) Program is a local non-residential energy efficiency incentive program that is designed for large commercial or industrial efficiency projects that require more flexibility than is offered by the statewide SPC program. A project may include a single customer or an aggregation of customers at multiple sites. The sites can have different measures, operating hours and energy use profiles. The aggregation feature allows for participation from customers who are unable or unwilling to participate in the statewide Express Efficiency or SPC programs.

The program is open to all SDGE customers that meet the eligibility requirements. To be eligible for the program, electric projects must save a minimum of 500,000 kWh per year. Natural gas projects must save a minimum of 25,000 therms per year. Savings are calculated with respect to applicable baseline conditions. All measures must be retrofits or replacements of existing, operating equipment. Measures applied for under this program cannot overlap other SDGE incentive programs.

The program incorporates the Local Energy Action Program (LEAP) component, which consolidates and enhances several successful 2004-05 programs implemented by the San Diego Regional Energy Office. The LEAP component is designed to focus on the specific and unique needs of public agencies and the military. It addresses the time, staffing and technical resource barriers that face these organizations. This program provides incentives for high impact measure groups such as interior lighting, cooling, HVAC controls and a variety of other large customized measures.

STANDARD PERFORMANCE CONTRACT PROGRAM (SDGE3025). The Standard Performance Contract (SPC) Program is a statewide non-residential energy efficiency incentive program. SPC offers financial incentives for the implementation of electric or gas energy efficiency projects. The program accommodates nearly all energy efficiency measures including lighting, air-conditioning, refrigeration, natural gas end use equipment, motors, controls, and other unique measures with verifiable energy

savings. The equipment must exceed government standards, operate at least five years and not overlap other incentive programs offered by the utility. The program is open to all SDGE commercial, industrial and agricultural customers, regardless of size, who pay the public good charge.

Under the SPC program, pre and post-inspections are required and the applicant must follow a multi-step application process using forms specifically for the SPC program. The forms are submitted to SDGE for evaluation prior to installing the equipment. SDGE staff work closely with the applicants to facilitate the review and payment process. This program provides incentives for high impact measure groups such as interior lighting and cooling.

2.4. Objectives of the PY2006/07 Verification Study

The 2006/07 verification study focused primarily on portfolio level high-impact measure and program combinations (high-impact combinations) as identified by the IOU filed cumulative accomplishment reports for 2006 and 2007. The study focused secondarily, and only as approved by the ED contract manager, on contract group level high-impact measures/measure groups. These are measures with the greatest claimed annual energy and demand savings and lifetime savings as well as net-benefits falling within each contract group. The verification study was conducted in strict accord with ED-approved procedures⁵ that satisfied the requirements of relevant CPUC directives.

Specifically, this study accomplished the following objectives:

- Quantified the number of eligible units installed and operational under the program through on-site data observations and compared this result to the number of units claimed in the IOU tracking database.
- Collected additional supporting information relevant to the installed measures, such as installation date, locations of the installed units and installed cost. Compared the installed cost to the cost value in the IOU tracking database.
- For DEER and work paper measures, collected vintage, building type, weather zone and other important data and used this data to confirm that the IOUs selected the most appropriate ID and savings (KWh, kW and therms) values. This was applicable only to the SCE2517 program because this was the only program that chose to report savings in this way.
- To the extent possible, determined the reasons for discrepancies (if any) between the claimed counts and the verified counts. Also, to the extent possible, determined the reasons for discrepancies between the verified project cost and the claimed project cost. For DEER and work paper measures (SCE2517 Express only), also determined the reasons for discrepancies between the verified DEER and work paper values (ID and savings) and the values selected by the IOUs.

⁵ *Guidance for Evaluation Contractors' – Draft Verification Plans for 2008 1st Verification Reports* (revised 11/5/2007), prepared by the CPUC for use by the evaluation contractors.

- For non-DEER measures, reviewed the ex-ante savings estimates (kWh and kW) prepared by the IOUs and made note of concerns and issues regarding the accuracy of the estimates that should be investigated further in the full evaluation.
- For CFLs, collected information through end user interviews regarding the number of units purchased at retailers or obtained through bulb give-aways, the number reported to have been installed and the number reported to have been placed in storage for future use.
- To the extent possible, collected additional performance data for use in the subsequent full evaluation analysis to reduce the number of customer contacts and reduce data collection costs.

2.5. Overview of Approach

A verification plan was written to describe a complete set of data collection, data analysis and reporting procedures necessary to prepare the verification report. Important aspects of these procedures that were applied to sampled measures are summarized below. Figure 2-1 provides a work flow diagram for the verification analysis.

Verification Sample Selection. For the first verification report, a sample of paid measures was drawn to represent measures paid by the programs in the contract group through December 31, 2007. A size stratified random sample was selected for each of the programs. The size strata was determined after examination of the program tracking databases. Measures in high-impact groups defined by MECT were represented in this sample in approximately the same proportions found in the population. This sample provided data needed to prepare the 2006-07 Verification Report. A second sample will be drawn in the future to represent measures paid during 2008, using the same design, to support the 2008 Verification Report.

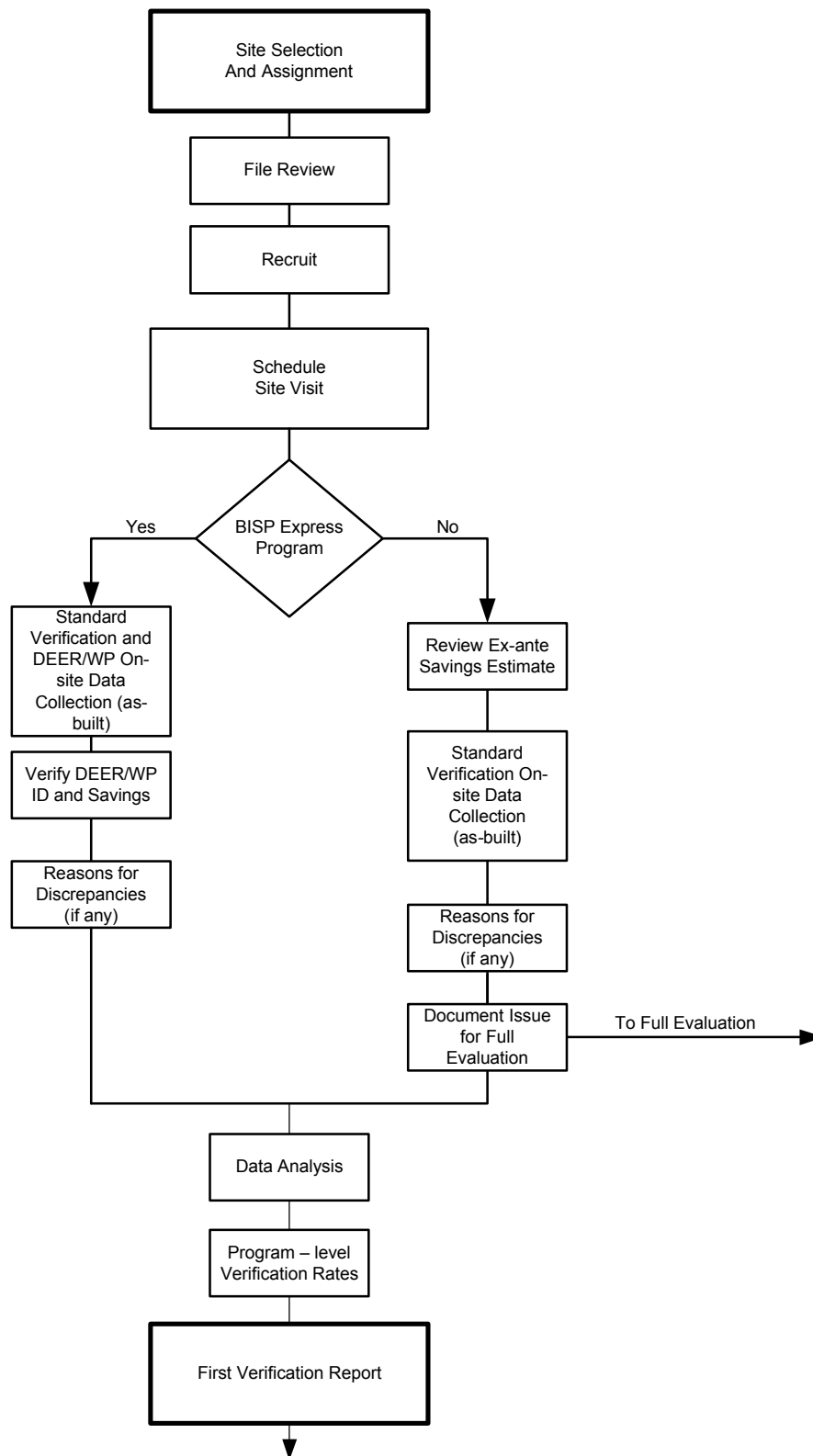
On-Site Data Collection. An on-site survey was performed to document the count of equipment installed and its eligibility and current operational status for sampled measures, and to verify the measure cost. It also collected information necessary to confirm the DEER ID or work paper ID (if applicable) and savings, and verify the project cost. For CFLs the survey collected purchase information that was used to identify upstream vs. downstream (rebated) measures and calculated the appropriate installation rate.⁶

Review Ex Ante Savings Estimates. The verification of each measure also included an assessment of the ex-ante savings estimate prepared by the IOUs. The ex-ante estimates came from one of three sources – a custom analysis of the measure savings (documented in the application file), work papers developed by the IOUs or the DEER database. The IOU tracking database documented which of these sources were used by the IOUs during program implementation. For DEER and work paper measures in the SCE Express program, the IDs and savings assigned by the IOU were reviewed and independently verified using data collected at the site. In cases where the verified ID and/or savings differed from the IOU assigned ID and savings, an attempt was made to determine the reasons for the discrepancy.

⁶ The selected sample did not include any CFLs so this data was never collected.

For the remaining programs, where the IOU savings estimate was based on a custom analysis, a more rigorous examination of the savings estimate was made. If the tracking system contained the wrong value, the correct value from the custom project report was identified and recorded. The savings analysis also included an examination of the custom savings analysis included in the application file for reasonableness. If the review resulted in concerns or issues related to the savings algorithm used or its application to the sampled measure, note was made in the verification database for further consideration in the full-evaluation. A re-calculation of energy savings was not made as part of the verification study.

Verification Reports. This first year verification report was prepared in accordance with the outline provided by ED in the Revised Verification Plan template and subsequent guidance. A Microsoft Excel workbook, with important verification database information, accompanies this report.

**Figure 2-1 Verification Work Flow Diagram**

3. VERIFICATION SAMPLE DESIGN AND SELECTION

This section describes the approach used to develop and implement sampling to support the first Verification Report (2006-07) for the Major Commercial contract group.

3.1. Sampling Methods

An initial sample design was developed and presented as part of the verification plan. This initial design addressed the sampling methods, stratification and issues associated with precision levels. The sample design utilized the ratio-estimation approach described in Chapter 13 of the Evaluation Framework Study⁷ and referenced in the California Energy Efficiency Evaluation Protocols.

A key input to the ratio-estimation sample planning methodology is the expected error ratio (er) for evaluation estimate of verification rate, which is the parameter of interest for this study. As with other sample planning methods, such as those based on an expected coefficient of variation, the error ratio is not known until the evaluation is complete. Instead, analysts must estimate the er from other related studies and work.

The precision level achieved for the combined 2002-2003 SPC impact evaluation sample was reviewed. The precision estimation process was carried out for that study as described in Chapter 13 of the Evaluation Framework Study. Specifically, the error ratio was calculated and the precision expected with alternative samples (as described on pages 358 and 365 of the Framework) was estimated, using the results from the 2002-2003 SPC ratio estimation process.⁸

Using the 2002-2003 SPC sample data, an error ratio (er) of 0.35 was calculated using the following formula:

$$\hat{er} = \frac{\sqrt{\left(\sum_{i=1}^n w_i e_i^2 / x_i^2\right) \left(\sum_{i=1}^n w_i x_i^2\right)}}{\sum_{i=1}^n w_i y_i}$$

where, w_i is the case weight, and, x_i is the tracking estimate of savings for each project, and y_i an estimate of the estimated savings from the ex post evaluation. For any sample, the “case weight” assigned to each sampled unit (in this design a sampled unit is a measure) is the inverse of that unit’s probability of selection. In stratified sample designs, the probability of selection is determined by the number of units selected in each strata and the number of units in the population that are contained in each strata.

⁷ Chapter 13 – Sampling, page 358, of the TecMarket Works, 2004. *2002 Evaluation Framework Study*, prepared by TecMarket Works for Southern California Edison Company, June. http://www.calmac.org/publications/California_Evaluation_Framework_June_2004.pdf.

⁸ See Chapter 7 of Quantum Consulting, 2005. *2003 Statewide Nonresidential Standard Performance Contract (SPC) Program Measurement and Evaluation Study*, prepared by Quantum Consulting, Inc. for Southern California Edison Company, SCE Study ID: SCE0206.01, December.

Again using the 2002-2003 SPC sample, the case weights were used to calculate the stratified ratio estimator, denoted, as follows:

$$\hat{B} = \frac{\hat{Y}}{\hat{X}} = \frac{\sum_{i=1}^n w_i y_i}{\sum_{i=1}^n w_i x_i}$$

The relative precision of the ratio estimator was then estimated, at the 90 percent confidence level, for alternative sample sizes using the equation below (which includes finite population correction):

$$rp = 1.64 \sqrt{1 - \frac{n}{N} \frac{er}{\sqrt{n}}}$$

The results were generally consistent with the example given in the Evaluation Framework Study (p. 366). Precision levels were found to be a highly non-linear function of sample size, i.e., precision is reduced more significantly at smaller sample sizes and less significantly at larger sample sizes.

Perhaps the most important aspect of any sample design for programs that address medium and large nonresidential customers is the use of stratification based on the amount of savings associated with each measure. In implementing size stratification typically measures are grouped into 3 to 5 strata from largest to smallest (except for programs with small participation, where care must be exercised in choosing the number of strata). It is not uncommon to find a 100-fold difference in average savings between the stratum with the largest and smallest projects, for example, the difference between strata 1 and 5 for the 2004-2005 SPC Evaluation was 75 fold. Size stratification for nonresidential sample designs can often result in an order magnitude decrease in the sample size required to meet a precision goal as they allow the sample to be disproportionately allocated to portions of the population that account for the greatest share of the variance in the ex ante estimate of savings. The er method in the Evaluation Framework Study assumes that a well stratified sample design is used to achieve the desired sampling efficiency.

3.2. Sample Scope and Domains

The ED/MECT required that this study address only high impact measure groups for each of the programs included in the Major Commercial contract group. A measure is an efficiency action implemented at a specific customer site. ED/MECT performed an analysis of all measure savings claimed by the IOUs as of June 30, 2007, classified each of them into a measure groups and then determined which combinations of program and measure groups were most important to the 2006-07 verification studies. Based on this analysis, ED/MECT determined which of the Major Commercial programs would be covered by this study. Some programs, such as SDGE3010, claim both electric and gas savings. For these dual-fuel programs two separate sample lists were developed. One contained all of the non-zero gas savings values. The other contained all the non-zero electric savings values. Each of these are referred to as program-fuel domains. In the case of the programs which claimed savings for only one fuel, there was only one program-fuel domain.

The ED/MECT directed that within program-fuel domain, the study was to cover only high impact measure groups. All measures within each program-fuel domain were group into the ED/MECT defined measure groups. Savings were summed by measure group and the measure groups were ranked from highest to lowest savings. The measure groups with highest savings that collectively accounted for at least 80 percent of the program-fuel domain savings were classified as high impact. The sample was selected only from high impact measure groups.

3.3. Initial Sampling Plan

Using the method described above, sample size was estimated for each program-fuel domain. Relative precision varied across the domains to account for the differences in the expected total savings among the domains, giving large samples to program with larger savings. The resultant sampling plan, as shows in Table 3-1, was presented in the verification plan, approved by ED/MECT. The sampling plan called for size stratification to improve sampling efficiency for each domain. Further, the plan was to sample with out regard to measure group. The number of sampled measures in each of the measure groups would be based on their natural frequency in the population and the distribution of their savings.

As shown in the table, no sample was assigned to SCE2560 and SCE2562 as their savings were too small and they had no high impact measure groups. In addition, after the initial sampling plan was approved, it was determined that the Gas domain savings for SDGE3025 was not sufficiently large to warrant inclusion in the study, so it was also dropped. This left five domains: SCE2517-Electric, SCG351-Gas, SDGE3010-Electric, SDGE3010-Gas, and SDGE3025-Electric.

Table 3-1: Estimated Number of Measures, Sample Size and Relative Precision

| Utility | ProgramID's | Estimated Number of electric Measures Projects | Estimated number of Gas Measure Projects | ~# of Sample Points – Electric | ~# of Sample Points – Gas | Estimated Relative Precision - Electric (er = 0.35) | Estimated Relative Precision - Gas (er = 0.35) |
|----------|-------------|--|--|--------------------------------|---------------------------|---|--|
| SCE | SCE2517 | 17,393 | | 60 | 0.23 | 90/7 | |
| SCE | SCE2560 | | | | | NA | NA |
| SCE | SCE2562 | | | | | NA | NA |
| SCG | SCG3513 | | 822 | | 30 | NA | 90/10 |
| SDGE | SDGE3010 | 756 | 174 | 25 | 25 | 90/12 | 90/12 |
| SDGE | SDGE3025 | 149 | 21 | 5 | 5 | 90/25 | 90/25 |
| Subtotal | SCE | | | 60 | 0 | 90/7 | NA |
| Subtotal | SCG | | | 0 | 30 | NA | 90/10 |
| Subtotal | SDGE | | | 30 | 30 | 90/10 | 90/10 |
| Total | | 18,297 | 1,017 | 90 | 60 | 90/6 | 90/8 |

3.4. Final Sampling Plan and Procedure

The objective of the final sampling plan was to define strata within each domain and allocate the sample among these strata. The distribution of measure savings was examined within each domain to determine optimum boundaries for each strata. The relative variance across the strata was examined to determine what portion of the sample would be allocated to each strata. The strata boundaries and sample allocations were determined using methods consistent with those documented in Chapters 4 and 5 of *Sampling Technique*, Cochran, 3rd Edition.

In addition, two techniques were used to further improve the efficiency of the sample. The first was to exclude measures with very small savings from each domain. Generally, in nonresidential programs a large number of measures account for a very small fraction of the total savings: 15 percent of the measures can account for less than .5 percent of savings. These small measures greatly increase variance and thus degrade sampling efficiency. The second technique was to define a certainty strata. Often a very small number of measures will account for a large fraction of total savings. Again, these greatly increase variance and the best remedy is to select them with certainty, thus removing them from the sampling error. In some program less than 10 measures can account for 20 or 30 percent of total program savings. Such certainty strata were defined for each domain.

A sampling workbook was developed for each domain and used to examine the effect of varying the number of strata, the portion of small savers excluded, and the number of certainty selections. These workbooks provided various estimates of the efficiency of the overall sample design and were used to select an efficient and practical design for each domain. The workbooks also assign a random number to each measure in the domain. In deploying the sample, all measures within a strata were sorted by this random number. Measures were recruited into the study in that order, stopping in each strata when its sample allocation was satisfied.

The entire sampling procedure was carried out twice. The first time it used the program tracking data from each IOU through June 30, 2007. A portion of this sample was deployed and some cases completed. However, when the December 31, 2007 tracking data was analyzed, it was discovered that many changes had occurred in the savings claimed (both the number of measures installed and savings per unit installed) for measure installed before June 30th, the total number of measures in each domain, and which measure groups were classified as high impact. ED/MECT concurred that these changes were sufficiently large to re-draw the sample.

3.5. Sample Disposition

The sample was recruited in the order describe above. Although some cases required special efforts all ultimately agreed to participate in this study. In total data collection was completed for 116 measures. The following tables show, for each domain, how the completed cases are distributed by strata and the population weight for each stratum. These weights are used in computing the verification rate from the sample results for each domain. The weights are computed separately for kWh, kW and therms and are based, as shown in the table, on the distribution of each these three savings parameter across the strata in each domain.

Also shown in these tables are the number of measures with small savings excluded from the domain, stratum 8, and the total measures that were in or not in the high impact measure groups. Strata 9, shown for each domain is the certainty stratum. The sample was selected randomly from each of the strata number 1 thru 5, strata 1 having the smallest average measure savings and the strata 5 the largest.

Table 3-2 SCE2517-Electric: Sample Completions and Population Weights

| SCE2517 | | Population Weights | | | | |
|---------------------------------|--------------------|--------------------|-------------|--------|---------|------|
| Strata | Sample Completions | Sum of Savings | | | Weights | |
| | | kW | kWh | therms | kW | kWh |
| | | | | | | |
| 1 | 10 | 9659 | 45177293 | | 0.15 | 0.10 |
| 2 | 8 | 15140 | 80534095 | | 0.23 | 0.19 |
| 3 | 7 | 14855 | 89347631 | | 0.22 | 0.21 |
| 4 | 7 | 12469 | 84113247 | | 0.19 | 0.19 |
| 5 | 6 | 7943 | 69668861 | | 0.12 | 0.16 |
| 9 | 9 | 6384 | 65521038 | | 0.10 | 0.15 |
| Total | 47 | 66450 | 434362164 | | 1.00 | 1.00 |
| Excluded Strata 8 | | 400 | 2,184,378 | | | |
| Total High Impact Measures | | 66,849 | 436,546,543 | | | |
| Total Not High Impact Measures1 | | 15,121 | 99,013,167 | | | |

Table 3-3 SCG3513-Gas: Sample Completions and Population Weights

| Strata | Sample Completions | Population Weights | | | | |
|---------------------|--------------------|--------------------|-----|-----------|---------|------|
| | | Sum of Savings | | | Weights | |
| | | kW | kWh | therms | kW | kWh |
| 1 | 10 | | | 1,260,729 | | 0.16 |
| 2 | 9 | | | 1,783,625 | | 0.23 |
| 9 | 6 | | | 4,840,762 | | 0.61 |
| Total Strata 1-5, 9 | 25 | | | 7,885,116 | | 1.00 |

| | Population Weights | |
|--------------------------------|--------------------|---------|
| | Sum of Savings | Weights |
| Excluded Strata 8 | 71,589 | |
| Total High Impact Measures | 7,956,705 | |
| Total Not High Impact Measures | 1,511,328 | |

Table 3-4 SDGE3010-Electric: Sample Completions and Population Weights

| Strata | Sample Completions | Population Weights | | | | | |
|--------------------------------|--------------------|--------------------|------------|--------|---------|------|--------|
| | | Sum of Savings | | | Weights | | |
| | | kW | kWh | therms | kW | kWh | therms |
| 11 | 5 | 1,706 | 7,976,463 | 71,271 | 0.16 | 0.12 | 0.07 |
| 2 | 6 | 1,904 | 13,604,049 | | 0.18 | 0.21 | |
| 4 | 6 | 3,186 | 15,925,356 | | 0.30 | 0.25 | |
| 5 | 3 | 3,148 | 16,565,019 | | 0.30 | 0.26 | |
| 9 | 25 | 631 | 9,807,645 | | 0.06 | 0.15 | |
| Total Strata 1-5, 9 | 45 | 10,575 | 63,878,531 | | 1.00 | 1.00 | |
| Excluded Strata 8 | | 890 | 1,615,948 | | | | |
| Total High Impact Measures | | 11,466 | 65,494,479 | | | | |
| Total Not High Impact Measures | | 689 | 8,103,824 | | | | |

Table 3-5 SDGE3010-Gas: Sample Completions and Population Weights

| Strata | Sample Completions | Population Weights | | | | | |
|---------------------|--------------------|--------------------|---------|-----------|---------|------|--------|
| | | Sum of Savings | | | Weights | | |
| | | kW | kWh | therms | kW | kWh | therms |
| 11 | 4 | 1706 | 7976463 | 71,271 | 0.16 | 0.12 | 0.07 |
| 9 | 3 | | | 1,020,840 | | | 0.93 |
| Total Strata 1-5, 9 | 7 | | | 1,092,111 | | | 1.00 |

| | Population Weights | |
|--------------------------------|--------------------|---------|
| | Sum of Savings | Weights |
| Excluded Strata 8 | 284,354 | |
| Total High Impact Measures | 1,376,465 | |
| Total Not High Impact Measures | 22,097 | |

Table 3-6 SDGE3025-Electric: Sample Completions and Population Weights

| Strata | Sample Completions | Population Weights | | | | | |
|--------------------------------|--------------------|--------------------|------------|--------|---------|------|--------|
| | | Sum of Savings | | | Weights | | |
| | | kW | kWh | therms | kW | kWh | therms |
| 1 | 4 | 456 | 2,336,034 | | 0.24 | 0.20 | |
| 2 | 3 | 625 | 3,766,575 | | 0.34 | 0.32 | |
| 3 | 4 | 538 | 4,044,583 | | 0.29 | 0.34 | |
| 9 | 3 | 245 | 1,578,690 | | 0.13 | 0.13 | |
| Total Strata 1-5, 9 | 14 | 1,864 | 11,725,882 | | 1.00 | 1.00 | |
| Excluded Strata 8 | | 164 | 539,214 | | | | |
| Total High Impact Measures | | 2,028 | 12,265,096 | | | | |
| Total Not High Impact Measures | | 811 | 6,704,609 | | | | |

The next table shows how sample completions for each of the high impact measure groups, within each domain. As expected, most of the measure groups include measures that only save electricity, so they are not represented in the two gas domains. The programs associated with the three electric domains differ considerably in their target markets and scale of operation, resulting in substantial differences in the distribution of cases across measure groups. For example, SCE2517 is a combination of SCE's Express and SPC program elements. The Express program delivers many thousands of generally small savings measures. SPC focuses on a much smaller number of larger savings measures. This combination of program elements is not found in either of the SDGE programs.

Table 3-7 Sample Completions by Measure Group and Program

| Measure Group | SCE2517 kWh | SGE3513 Therm | SDGE3010 kWh | SDGE3010 Therm | SDGE3025 kWh | Total |
|-----------------------|-------------|---------------|--------------|----------------|--------------|-------|
| C&I Cooling | 0 | 0 | 1 | 0 | 7 | 8 |
| C&I HVAC Controls | 0 | 0 | 12 | 0 | 0 | 12 |
| C&I Interior lighting | 25 | 0 | 9 | 0 | 7 | 41 |
| C&I Mtr controls | 9 | 0 | 0 | 0 | 0 | 9 |
| C&I Other | 6 | 25 | 3 | 5 | 0 | 39 |
| C&I Process | 5 | 0 | 0 | 0 | 0 | 5 |
| C&I Refrigeration | 2 | 0 | 0 | 0 | 0 | 2 |
| Grand Total | 47 | 25 | 25 | 5 | 14 | 116 |

4. VERIFICATION PROCEDURES

This section describes the procedures that were followed for measure verification at a sampled measure. The verification plan⁹ provides additional documentation of the verification procedures. The procedures began with the assignment of a site to a lead analyst and ended with final documentation in the project database.

4.1. Site Assignment

Sites were assigned to each of the lead analysts. Site assignments were grouped by common sponsorship or corporation, as appropriate. The following documents were organized by site and incorporated into a site workbook:

- **Recruitment Form.** A form, partially pre-filled from the IOU tracking database and application files, was provided for each sampled measure.
- **Contact Log.** A form was provided for each measure to record contact name and the outcome for significant communications with the customer.
- **Application Files.** A copy of all the relevant IOU application files.

4.2. Site Recruitment

As part of recruiting (i.e., asking the customer to participate) a verification site, a letter was sent to the customer to introduce the verification and to describe their responsibilities in participation. The lead analysts were responsible for recruiting their assigned sites, after they performed a review of the application file. The application review helped the analysts to determine customer contact information and gain a thorough understanding of physical and operational characteristics of the sampled measure. When the review was completed, the analyst recruited the site.

Special care was exercised in approaching corporations, which had multiple sites. Some corporations had central staff, which were responsible for energy efficiency improvements. On the first call the central contact was identified and an effort was made to minimize the number of contacts with that person.

If the customer refused to participate or was not responsive to recruitment, the ED project manager was notified. On a case-by-case basis the ED contract manager determined if the assignment of a replacement site was appropriate. The contract manager assisted with the recruitment of some difficult sites. Special correspondence related to liability coverage, security or other matters was sent to the customer on an as-needed basis.

Recruitment included confirmation that someone at the site was familiar with the sampled measure and knows its location. If the site contact did not know, or could not determine the location of the items, the site was rejected.

⁹ PY2006/07 Verification Report Plan - Major Commercial Contract Group, prepared by SBW Consulting, Inc. and Itron, Inc. for the California Public Utilities Commission, October 31, 2007.

Appropriate entries were made in the Contact Log as the recruitment process was completed for each site. Entries in the Contact Log continued to be made, as appropriate, during the course of work at each site. The completed Recruitment Forms were incorporated into the site workbook.

4.3. Scheduling On-Site Data Collection

An on-site survey was scheduled using the following guidelines:

- Sites were grouped geographically to minimize travel time between sites.
- Appointments were made one week in advance (when possible) to give the customer adequate notice. Site contacts were called the day before the site visit to confirm the appointment.
- The name and telephone number (including cellular) of the person conducting the site visit were left with the contact so that he/she could be reached if it became necessary to reschedule
- The IOU representatives, that had expressed interest in helping set up or being present during all or a portion of the on-site survey work, were notified.

The Site Scheduling Form was used to record all of the information related to scheduling on-site data collection activities for each site.

4.4. On-Site Data Collection

The on-site survey documented the count of equipment installed and its eligibility and current operational status. It also collected information (e.g., vintage, building type, climate zone) necessary to confirm the DEER and work paper ID (if applicable) and tracking database savings value; and verify the project cost. When the CFL measure was selected, the survey collected purchase information that was used to calculate the installation rate, using a method provided by the CPUC. It is noted that the selected sample did not include any CFL measures, so this portion of the survey was never implemented.

On-site data collection was limited to the information that was needed to complete the Verification form. There was one form for each sampled measure. Appendix A provides a copy of the verification data collection form and the accompanying instructions that were used by field staff.

4.4.1. Sampling within measure

It was desirable to have a census count for the verification of all measures. However, for measures with an unusually large count or limited site access, the count was based on an extrapolation of a representative sample of installed devices. The feasibility and suitability of using a sampling approach for a selected measure was determined by the SBW project manager on a case-by-case basis.

In cases where sampling was appropriate, care was taken in selecting a sample that was representative of the population being considered. Very large measure counts were encountered for some lighting measures

in large facilities. For lighting measures the procedures developed by Xenergy¹⁰ for SCE were used as the basis for selecting a representative sample.

For measures other than lighting, the selection of a sample that was representative of the entire population of installed devices was based upon a careful consideration of the circumstances encountered in each case. The general approach to sample selection was to divide the population into discrete subsets of devices that varied by important characteristics that affected energy savings and randomly select a sample from each important subset. For example, the population of motors in a large efficient motor population could be categorized by size (installed horsepower), efficiency rating, annual operating hours and/or other important attributes of the measure. The number of categories selected was based on the variation in the attributes and the expected counts that was isolated by the categorization. For ease of data collection, groupings were limited to attributes that have a significant impact on energy savings.

4.5. Review of Ex-Ante Savings Estimates

The verification of each measure also included an assessment of the ex-ante savings estimate prepared by the IOUs. The ex-ante estimates came from one of three sources – a custom analysis of the measure savings (documented in the application file), work papers developed by the IOUs or the DEER database. The IOU tracking database documented which of these sources were used by the IOUs during program implementation.

For DEER and work paper measures in the SCE2517 Express program, the lead analyst reviewed the ID and unit savings value assigned by the IOU and independently determined the most appropriate ID and savings value, using data collected at the site. In cases where the ID or savings differed, an attempt was made to determine the reasons for the discrepancy.

For the remaining programs, where the IOU savings estimate was based on a custom analysis, a more rigorous examination of the savings estimate was made. The lead analyst examined the savings analysis included in the application file for reasonableness. If this review resulted in concerns or issues related to the savings algorithm used or its application to the sampled measure, note was made in the verification database for further consideration in the full-evaluation. A re-calculation of energy savings was not made as part of the verification study.

All relevant materials in the file were examined to fully understand the data elements available, and the completeness of the data, and to identify gaps or needs for supplemental information. Next, the calculation methods and algorithms used to estimate project savings were examined to assess whether or not the methods employed were rigorous, consistent with industry best practices, and included the necessary factors and elements to produce realistic savings estimates. In addition, a quality assurance check was performed of the viability and appropriate use of such items as:

¹⁰ Xenergy Consulting, Inc. NonResidential Standard Performance Contracting Program Recommended New Sampling Methods for Lighting. (Southern California Edison.2000)

1. Measure performance variables (e.g., pre- and post-installation energy performance and/or efficiency, equipment size, capacity and output)
2. Reasonableness of the pre- and post- installation technical and performance assumptions;
3. Other variables that account for interactive effects between energy systems, the diversity of a population of devices, and/or coincidence with the hour/day type being analyzed
4. Baseline values, including existing versus standard efficiency assumptions
5. High efficiency values, including standard versus high efficiency assumptions
6. Annual energy and demand savings estimates
7. Energy and demand savings calculations assumptions
8. Output versus rated capacity
9. Data availability and use
10. Performance factors such as coincidence factors, load factors, operating hours, and equivalent full load hours
11. Consistency and transparency of terminology and calculations used to define savings.

Comments resulting from this work were entered into the program database for use later in the full impact evaluation. Entries included items such as alternative approaches to estimating savings, or different values for key input assumptions that drive savings estimates. Missing data and questions about the savings calculation methods were also noted. Measures where the IOU's claimed savings were reasonable and verifiable were also noted.

Preparing Site Verification Workbooks

When the counts were finalized, data from the field data sheets were entered into the Site Workbook. Appropriate data were entered into the verification Access database for all sites visited. The database calculated a verification rate (formula provided in section 5.1 below) for each measure.

5. VERIFICATION ANALYSIS AND FINDINGS

This section presents and discusses the verification analysis and findings for the Major Commercial contract group measures installed through December, 2007 (program years 2006 and 2007). The section begins with a discussion of the verification results obtained for the sampled measures. Then the verification results are examined across all measures in the population and the overall verification rates for each program are presented. Finally the results obtained for other topics of interest are discussed.

5.1. Verification Rates for Sampled Measures

The primary objective of this study was the quantification of the number of eligible units installed and operational. This was done through the calculation of a verification rate. For the SPC portion of the SCE2517 program and the three Sempra programs, four factors were considered in the calculation of the verification rate for a measure. They included:

- Verification quantity of eligible, installed and operational units
- Ex ante quantity of eligible, installed and operational units
- IOU tracking database value for total savings
- Verification value for total savings, including corrections to ex ante value for data entry errors.

$$\text{Verification rate} = (\text{unit}_{\text{verify}} / \text{units}_{\text{ex ante}}) \times (\text{total savings}_{\text{verify}} / \text{total savings}_{\text{IOU database}})$$

For the Express Efficiency portion of the SCE2517 program, the verification and ex ante unit savings for each measure entered into the calculation.

$$\text{Verification rate} = (\text{units}_{\text{verify}} \times \text{savings} / \text{unit}_{\text{verify}}) / (\text{units}_{\text{ex ante}} \times \text{savings} / \text{unit}_{\text{ex ante}}) \times (\text{total savings}_{\text{eval}} / \text{total savings}_{\text{IOU database}})$$

In most cases the values determined in the verification for quantity, unit savings and total savings were the same as the corresponding ex ante values. However, in some cases the verification values were different from the ex ante values. These differences are discussed below.

5.1.1. Unit savings for SCE2517 – Express Program

The SCE2517 Express Efficiency program was unique in that the calculation of the verification rate considered the verification and ex ante unit savings in addition to unit counts. It is the only program in the Major Commercial contract group that uses DEER and work paper unit savings as the basis for the ex ante savings estimates. Table 5-1 compares the verification unit savings to the ex ante unit savings for the measures where differences were noted. The table shows that 15 of the 22 Express Efficiency measures

that were included in the sample had differences between the verification and ex ante unit savings values. In most cases (9 of 15) where differences occurred, the verification unit savings value was lower than the corresponding ex ante value. However in some cases (6 of 15) the verification unit savings value was greater. The difference ranged across measures from a 31% increase in the savings from the verification to an 80% decrease in savings. In all cases the differences were caused by either the assignment of the wrong ID (DEER or work paper) or the assignment of the wrong unit savings for a correct ID. A discussion with SCE about these results indicated that the wrong assignments were due to a problem with the IOU tracking database. The utility has been aware of the problem and has been working on a correction to it. Correct ID and workpaper assignments for the 2006 and 2007 program years will be included in the 2008 quarterly data deliveries.

Table 5-1 Unit Savings for Sampled Measures with Differences Between Verification and Ex Ante Values

| Measure ID | Unit Savings (ex ante) | Unit Savings (verification) | % Difference |
|------------|------------------------|-----------------------------|--------------|
| | kWh | kWh | kWh |
| M00021 | 337 | 351 | 4.1 |
| M00023 | 50 | 33 | -33.5 |
| M00024 | 48 | 50 | 3.4 |
| M00026 | 355 | 259 | -27.1 |
| M00027 | 33 | 44 | 31.2 |
| M00028 | 48 | 37 | -23.5 |
| M00039 | 48 | 33 | -30.8 |
| M00040 | 680 | 684 | 0.5 |
| M00041 | 355 | 387 | 8.9 |
| M00042 | 1112 | 880 | -20.9 |
| M00044 | 44 | 34 | -22.3 |
| M00052 | 100 | 20 | -80.1 |
| M00054 | 983 | 865 | -12.0 |
| M00056 | 76 | 79 | 4.2 |
| M00065 | 1149 | 880 | -23.4 |

5.1.2. Verification Rates for Program and Measure Group Combinations

Verification rates were calculated for each of the 116 sampled high impact measures, using the equations discussed above. Appendix B provides a complete listing of the verification rate (kW, kWh and therms) and other important information for each of the sampled measures. The appendix shows that a verification rate other than one was calculated for 26 of the 116 sampled high impact measures (22%). For four measures the calculated verification rate was greater than one. For the remaining 22 measures the calculated verification rate was less than one. The verification rates for the individual measures ranged

from a high of 1.31 to a low of zero (program measure was replaced). The verification rates for one measure (M00174) was reduced somewhat because the verification determined that the total ex ante savings value in the IOU database was not consistent with the application file.

Table 5-2 provides a summary of the calculated verification rates by measure group within program. The table shows a verification rate of one or close to one for most of the program/measure group combinations. The lowest verification rate of 0.60 is observed for the C&I Refrigeration high impact measure group in the SCE2517 program. Although this rate is relatively low, it has a minor impact on the verification rate for the entire SCE2517 program because this high impact measure group (identified as a high impact measure based on IOU total portfolio savings) accounts for a very small portion (less than 1%) of the SCE2517 program's total ex ante savings. A C&I Interior Lighting kWh verification rate of 0.874 (SCE2517 program) is noted as the next lowest value. Verification rates of 0.90 or above are observed for all other program/measure group combinations. The implications of these rates for the sampled cases on the program-level estimates are discussed in section 5.2 below.

Table 5-2 Summary of Verification Rates for Sampled Measures

| Program | Measure Group | Savings (ex ante) | | | Verification Rate | | |
|--------------|-----------------------|-------------------|----------|---------|-------------------|-------|--------|
| | | kW | kWh | therms | kW | kWh | therms |
| SCE2517kWh | C&I Interior lighting | 1351 | 8624578 | 0 | 0.940 | 0.874 | |
| | C&I Mtr controls | 1256 | 18305114 | 0 | 0.998 | 0.987 | |
| | C&I Other | 4884 | 45825702 | 0 | 1.000 | 1.000 | |
| | C&I Process | 1151 | 10322160 | 0 | 1.000 | 1.000 | |
| | C&I Refrigeration | 34 | 319165 | 0 | | 0.600 | |
| SCG3513Therm | C&I Other | 0 | 0 | 6410840 | | | 0.955 |
| SDGE3010kWh | C&I Cooling | 133 | 1020659 | 0 | 1.000 | 1.000 | |
| | C&I HVAC Controls | 794 | 13273249 | 0 | 0.997 | 0.997 | |
| | C&I Interior lighting | 412 | 2455232 | 0 | 0.999 | 0.999 | |
| | C&I Other | 381 | 3482581 | 121694 | 1.000 | 1.000 | 1.000 |
| Therm | C&I Other | 383 | 3972746 | 1043123 | 1.000 | 1.000 | 1.000 |
| SDGE3025kWh | C&I Cooling | 345 | 2430637 | 0 | 1.000 | 1.000 | |
| | C&I Interior lighting | 214 | 1029401 | 0 | 0.934 | 0.934 | |

5.1.3. Reasons for Verification Rates Not Equal to 1

A secondary objective of the first year verification study was to determine the reasons why some of the verification rates were not equal to one. During data collection, the reasons for differences in quantities

and units savings were noted. For most measures a single reason was determined. However, in some cases, there was more than one reason for the verification rate not being equal to one.

The reasons were compiled and summarized below in Table 5-3. The table shows that a verification rate other than one was computed for 26 of the 116 sampled measures (22%). Nearly all (20 of 26) of the instances occurred in the SCE2517 program. The primary reason cited for verification rates other than one was the verification observed quantity being less than the ex ante quantity. Other primary reasons were the incorrect assigned IDs or incorrect assigned unit savings values for DEER or workpaper measures in the SCE2517 Efficiency Express program. Other secondary reasons included the measure being removed, the measures not being operational, incorrect IOU tracking savings values and the customer switching utilities.

Table 5-3 Reasons for Verification Rates not Equal to 1

| Program | Measure Group | Reason Verification Rate \neq 1 | Frequency |
|--------------|-----------------------|---|-----------|
| SCE2517kWh | C&I Interior lighting | Incorrect DEER Run ID selected | 1 |
| | | "Incorrect value taken from DEER; Expected number of units not installed; Some units not operational" | 1 |
| | | Incorrect value taken from Work paper | 7 |
| | | Incorrect Work paper selected | 2 |
| | | "Incorrect Work paper selected; Expected number of units not installed" | 1 |
| | | Installed units have been replaced | 2 |
| | | Minor differences in quantity | 1 |
| | | Some lamps burnt out | 1 |
| | | Some units not operational | 1 |
| | C&I Mtr controls | Incorrect DEER Run ID selected | 1 |
| | C&I Refrigeration | Incorrect Work paper selected | 1 |
| SCG3513Therm | C&I Other | Customer switched utilities | 1 |
| | | Expected number of units not installed | 1 |
| SDGE3010kWh | C&I HVAC Controls | Database savings value does not match application file value | 1 |
| | C&I Interior lighting | Some lamps burnt out | 1 |
| SDGE3025kWh | C&I Interior lighting | Expected number of units not installed | 2 |
| | | | 1 |

5.2. Program-level Verification Rates

To produce program-level estimates of verification rates, individual verification rates for the sampled measures were weighted by the size of their respective kWh or therm impacts and by the proportion of the total program impacts represented by each stratum, as follows:

- Within each stratum, individual verification rates for the sampled measures were weighted using the size of the kWh or therm impacts for each sample measure. This yielded stratum-level verification rates.
- The stratum-level verification rates were then weighted using the population kWh or therm impacts for each stratum, yielding a program-level verification rate and an associated 90% confidence interval.

The verification rates by stratum, as well as the program-level verification rate and the associated confidence interval for program SCE2517 are shown in Table 5-4a. . The program-level verification rate for kW and kWh is 0.94 and 0.93, with a relative precision of 11% and 12% respectively, at the 90 percent confidence level. Similar information for program SCG3513 is provided in Table 5-4b. The program-level verification rate for therms is 0.96, with a relative precision of 21% at the 90 percent confidence level. The program-level verification rate for the SDGE3010 program is 1 for electric and gas, as shown in Table 5-4c. As such the variance, which is the square of the difference between the ex ante savings and the verification rate adjusted savings is zero. So a relative precision and confidence level could not be estimated. The program-level verification rates for program SDGE3025 is shown in Table 5-4d. The table shows kW and kWh verification rates of 0.94 and 0.95, respectively. A relative precision of 9% and 6% at the 90 percent confidence level were calculated for kW and kWh, respectively.

Table 5-4a Program-level Verification Rates for SCE2517 by Strata

| SCE2517 Strata | Verification Rate | |
|-------------------|-------------------|--------------|
| | kW | kWh |
| 1 | 0.96 | 0.85 |
| 2 | 0.91 | 0.92 |
| 3 | 0.92 | 0.88 |
| 4 | 0.94 | 0.94 |
| 5 | 1.00 | 1.00 |
| 9 | 1.00 | 1.00 |
| Weighted VR | 0.94 | 0.93 |
| 90 Percent CI | 0.84 to 1.05 | 0.82 to 1.05 |
| N | 47 | 47 |

Table 5-4b Program-level Verification Rates for SCG3513 by Strata

| SCG3513 | Verification Rate |
|---------|-------------------|
|---------|-------------------|

| | therms |
|---------------|---------------|
| 1 | 0.79 |
| 2 | 0.99 |
| 9 | 1.00 |
| Weighted VR | 0.96 |
| 90 Percent CI | 0.76 to 1.16 |
| N | 25 |

Table 5-4c Program-level Verification Rates for SDGE3010 by Strata

| SDGE3010 Strata | Verification Rate | | |
|----------------------------|--------------------------|----------------|---------------|
| | kW | kWh | therms |
| 1 | 1.00 | 1.00 | 1.00 |
| 2 | 1.00 | 1.00 | |
| 3 | 1.00 | 1.00 | |
| 4 | 1.00 | 1.00 | |
| 5 | 0.99 | 0.99 | |
| 9 | 1.00 | 1.00 | 1.00 |
| Weighted VR | 0.998 to 1 | 0.998 to 0.998 | 1.00 |
| 90 Percent CI | 0.00 | 0.00 | |
| N | 25 | 25 | 5 |

Table 5-4d Program-level Verification Rates for SDGE3025 by Strata

| SDGE3025 Strata | Verification Rate | |
|----------------------------|--------------------------|-------------|
| | kW | kWh |
| 1 | 0.96 | 0.96 |
| 2 | 0.86 | 0.89 |
| 3 | 0.98 | 0.99 |
| 9 | 1.00 | 1.00 |
| Weighted VR | 0.94 | 0.95 |
| 90 Percent CI | 0.86 to 1.02 | 0.9 to 1.01 |
| N | 14 | 14 |

Program-level verification rates are also provided by measure group within program in Tables 5-5a through 5e. The relative precision at the 90% confidence level could not be computed for the measure groups because there was an insufficient number of cases completed in the measure groups. These tables show program-level verification rates that vary from 0.90 to 1.0 across the measure groups.

Table 5-5a Program-level Verification Rates for SCE2517 by Measure Group

| SCE@2517 kWh Measure Group | Verification Rate | |
|---|--------------------------|------------|
| | kW | kWh |
| C&I Interior lighting | 0.95 | 0.92 |
| C&I Other | - | - |
| C&I Mtr Controls | - | - |
| C&I Refrigeration | - | - |
| C&I Process | - | - |

Table 5-5b Program-level Verification Rates for SCG3513 by Measure Group

| SCG3513 Therm Measure Group | Verification Rate |
|--|--------------------------|
| | therms |
| C&I Other | 0.96 |

Table 5-5c Program-level Verification Rates for SDGE3010 by Measure Group - Electric

| SDGE3010 kWh Measure Group | Verification Rate | |
|---|--------------------------|------------|
| | kW | kWh |
| C&I Interior lighting | 0.998 | 0.998 |
| C&I HVAC Controls | 0.996 | 0.994 |
| C&I Cooling | - | - |
| C&I Other | - | - |

Table 5-5d Program-level Verification Rates for SDGE3010 by Measure Group - Gas

| SDGE3010 Therm Measure Group | Verification Rate |
|---|--------------------------|
| | therms |
| C&I Other | 1.00 |

Table 5-5e Program-level Verification Rates for SDHE3025 by Measure Group

| SDGE3025 kWh Measure Group | Verification Rate |
|---|--------------------------|
| | kW |

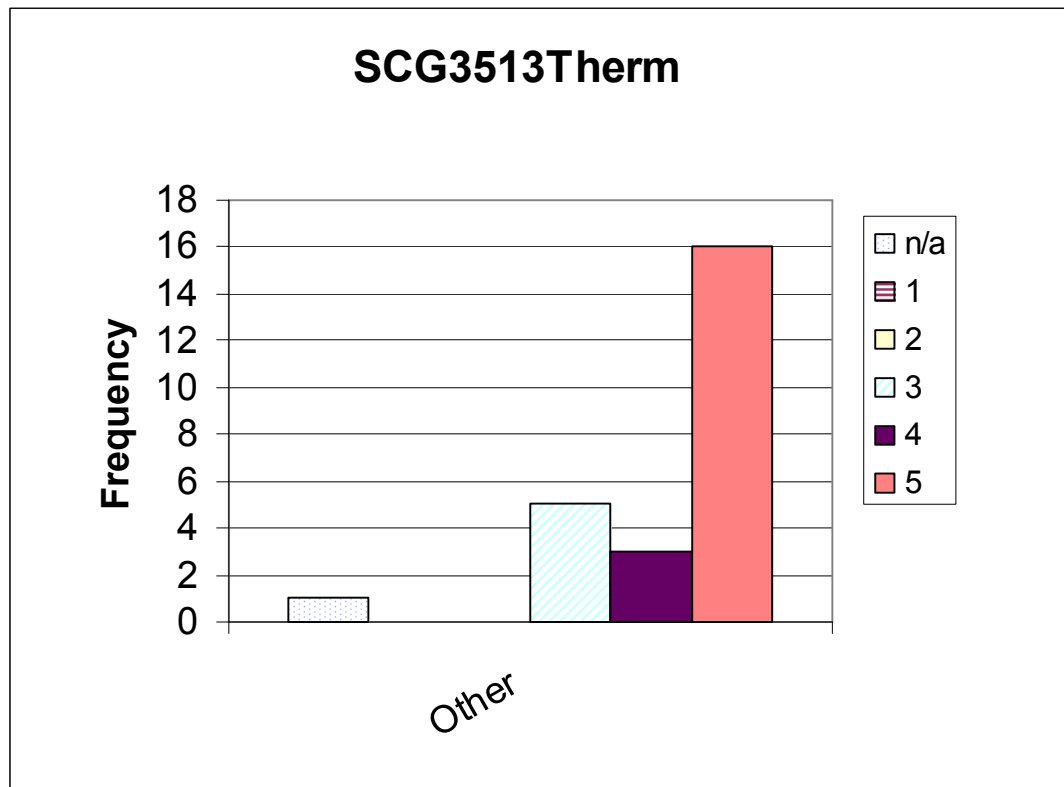
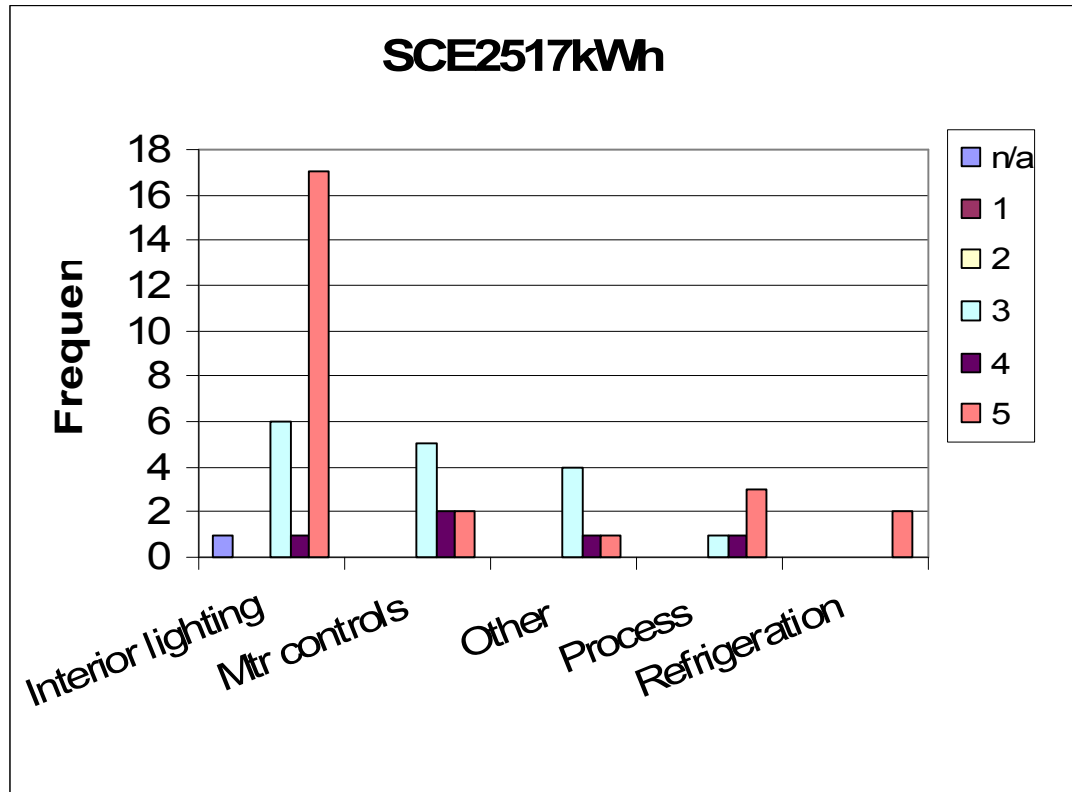
| SDGE3025 kWh Measure Group | Verification Rate kW |
|-------------------------------|-------------------------|
| C&I Interior lighting | 0.90 |
| C&I Cooling | 1.00 |

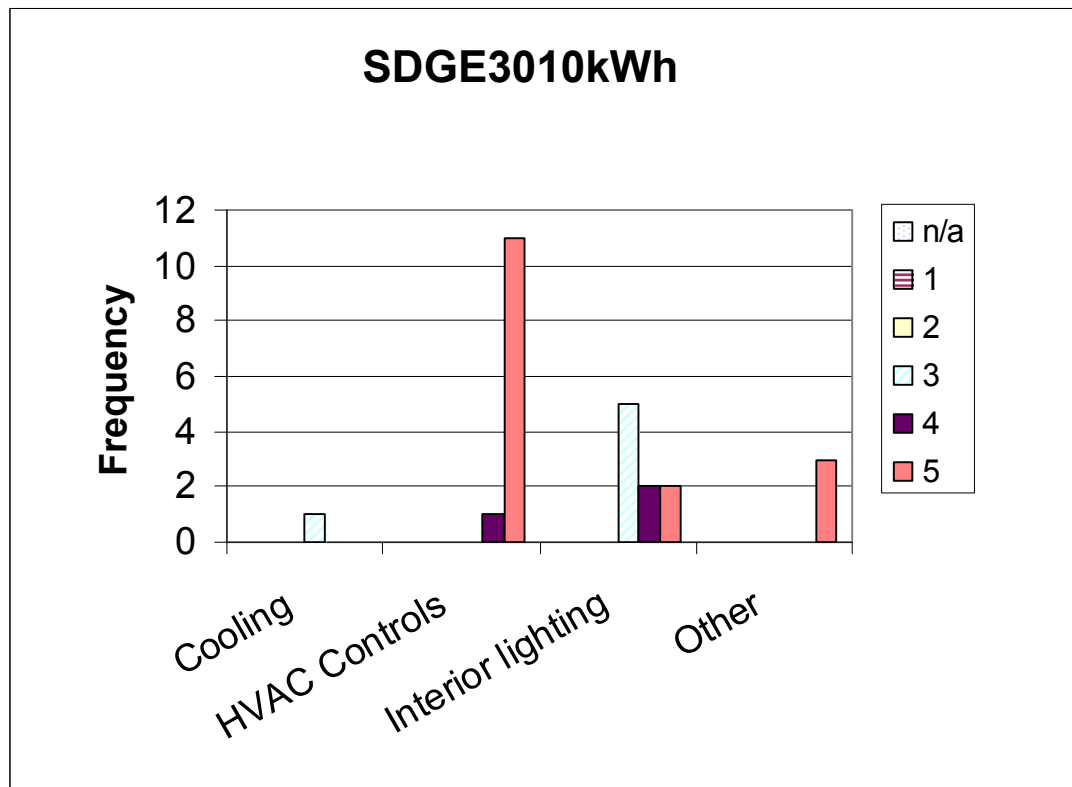
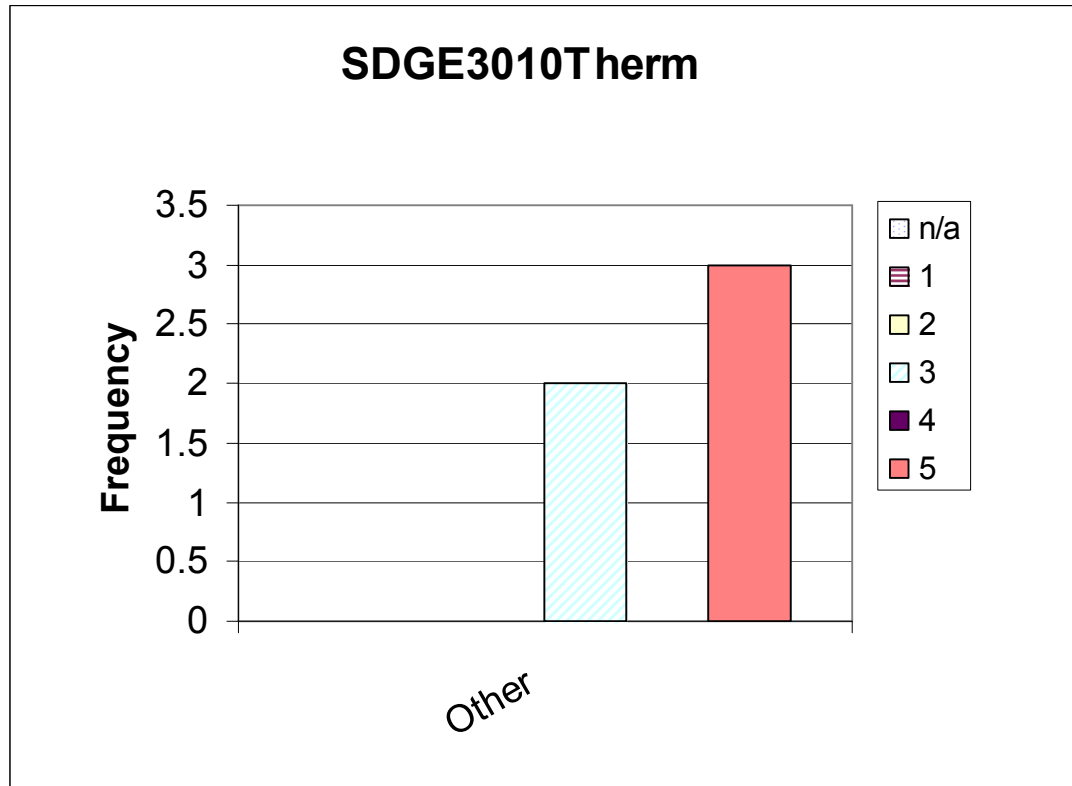
5.3. Other Findings

Other secondary objectives of the first year verification study included an assessment of installation quality and measure cost; and a review of the ex ante savings estimate for all measures. During data collection, information necessary to support these analyses was compiled from a review of the application files, on-site observations and interviews. The results from this effort are discussed below.

5.3.1. Installation Quality

During data collection, the field staff were asked to rate the installation quality on a 1 to 5 scale, with a 5 being an excellent installation and a 1 being an unacceptable installation. The ratings were compiled and averaged across measure groups within programs. The results are summarized in Figures 5-1a through 5-1e by measure group within program. The figures show that a quality rating of 5 (excellent) was most frequently specified for 9 of the 13 program/measure group combinations. Quality rating 5 was the only rating assigned for 3 of the 13 program/measure group combinations. Quality rating 1 (unacceptable) or 2 (poor) were never specified. All measures were rated as acceptable or better.





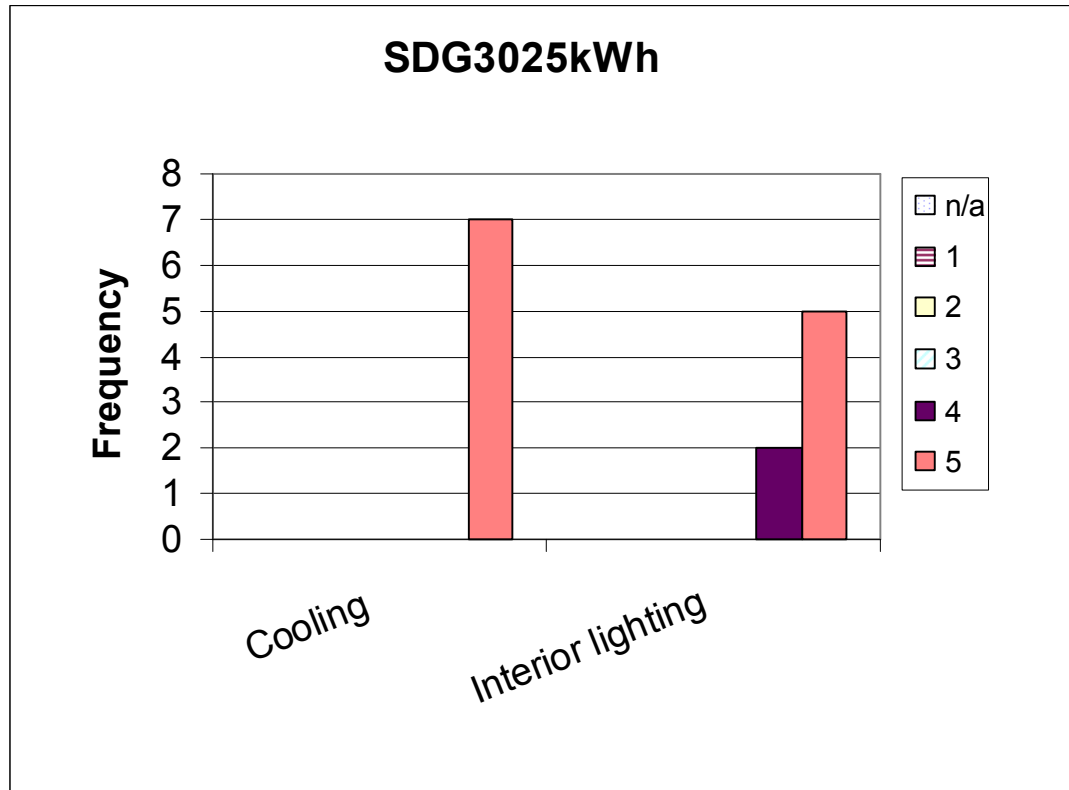


Figure 5-1 Summary of Installation Quality Rating by Measure Group and Program

5.3.2. Measure Cost

The measure costs were verified in two ways. First, the measure cost in the IOU tracking database was compared to the measure cost in the application file and the differences, if any, were reconciled. In addition field staff were asked to further confirm the measure cost while in the field through interviews with facility staff. Both of these cost confirmations proved to be more difficult than expected.

Examination of the measure cost information in the IOU tracking database showed that cost information was entered for only 28% of the measures. The SCE2517 SPC program was the only program that consistently entered measure cost data. With the lack of cost information in the IOU tracking data, the cost confirm with the application file information could be completed on only a limited basis. It was limited further by the fact that the cost in the application file was often for a measure package that could not be broken down into its individual measure components. Since the sample for this study was selected on a measure basis, cost information on individual measures in a package was necessary.

The on-site cost verification had limited success because the facility staff often had little knowledge of the measure cost many months after the measure was installed. In four cases the on-site facility staff did provide information that slightly changed the measure cost. These four cases are summarized in Table 5-6. The table shows that the cost increased in three cases and decreased in one case. In all cases the change in the measure cost was ten percent or less.

Table 5-6 Measure Cost Differences from Facility Staff Interviews

| Program | Measure Group | Reason for Cost Difference | Frequency |
|----------------|-----------------------------|--|------------------|
| SCE2517kWh | C&I Mtr controls | Contractor invoices showed 3% higher cost | 1 |
| | C&I Process | Plant engineer provided cost documents showing less than 1% difference | 1 |
| SCG3513Therm | C&I Other | Plant engineer provided cost documents showing 10% higher cost | 1 |
| | C&I Other | Project manager documented costs 3% lower than expected | 1 |

5.3.3. Review of Ex Ante Savings Calculations

During the review of the ex ante savings estimates, the reviewers were asked to rate the quality of documentation of the baseline and efficient conditions in the application file. The ratings were assigned on a 1 to 3 scale with 1 being poor documentation, 2 being average documentation and 3 being excellent documentation. Using the same scale, the reviewers were also asked to rate the methodology used in preparing the ex ante savings estimate. An overall rating was computed as the sum of the individual documentation and savings methodology ratings, with a maximum allowable value of 6. The ratings were compiled and averaged across measure groups within programs. The results are summarized in Table 5-7. The table shows average ratings between 1.0 and 2.3 for the baseline and efficient condition documentation across the measure groups and programs. The table shows a similar rating range of 1.0 to 2.2 for the savings estimation methodology across the measure groups and programs. The overall ratings ranged from 2.0 to 4.5.

Poor ratings were assigned to the baseline and efficient condition documentation when the information included in the application file was missing, inadequate or confused to the point that the reviewer could not get a thorough understanding of the assumed baseline and/or efficient conditions. Excellent ratings were assigned when the descriptions and other data necessary were provided in enough detail for the reviewer to gain a thorough understanding of the baseline and efficient conditions.

Poor ratings were assigned to the energy savings methodology when the reviewer could not understand the methodology that was used; when the methodology was incorrect or too simplified or based on data that was not site-specific (e.g., DEER); or when insufficient information was provided to support the application of the methodology. Excellent ratings were assigned when the reviewer could completely understand the ex ante methodology and felt that the ex ante methodology was accurate enough to be used again in the full evaluation (if the sampled measure was selected for the full evaluation). The availability of measured data and analyses from measurement and verification performed during measure implementation also contributed to an excellent rating.

Table 5-7 Summary of Ex Ante Review Ratings

| Program | Measure Group | Average Rating | | |
|---------------|-----------------------|----------------------|-----------------------|-----------|
| | | (base/eff condition) | (savings est. method) | (overall) |
| SCE2517kWh | C&I Interior lighting | 1.3 | 1.3 | 2.6 |
| SCE2517kWh | C&I Mtr controls | 1.6 | 1.6 | 3.1 |
| SCE2517kWh | C&I Other | 2.3 | 2.2 | 4.5 |
| SCE2517kWh | C&I Process | 2.0 | 2.0 | 4.0 |
| SCE2517kWh | C&I Refrigeration | 2.0 | 2.0 | 4.0 |
| SCG3513Therm | C&I Other | 1.8 | 1.8 | 3.6 |
| SDGE3010kWh | C&I Cooling | 1.0 | 1.0 | 2.0 |
| SDGE3010kWh | C&I HVAC Controls | 1.0 | 1.9 | 2.9 |
| SDGE3010kWh | C&I Interior lighting | 2.0 | 2.0 | 4.0 |
| SDGE3010kWh | C&I Other | 1.7 | 1.3 | 3.0 |
| SDGE3010Therm | C&I Other | 1.6 | 1.4 | 3.0 |
| SDGE3025kWh | C&I Cooling | 1.6 | 1.9 | 3.4 |
| SDGE3025kWh | C&I Interior lighting | 2.0 | 2.0 | 4.0 |

6. CONCLUSIONS

From the results of the first year verification analysis the following key conclusions are drawn:

1. Verification rates for sampled measures – a verification rate of 1 (verification equal to ex ante) was computed for 90 of the 116 sampled measures (78%). For four measures the verification rate was greater than one. For the remaining 22 measures, the verification rate was calculated to be less than one. The primary reason cited for verification rates other than one was the verification observed quantity being less than the ex ante quantity. Other primary reasons were the incorrect assigned IDs or incorrect assigned unit savings values for DEER or workpaper measures in the SCE2517 Efficiency Express program.
2. Program level verification rates – the program level verification rates for kWh ranged from a low of 0.93 for SCE2517 to a high of 1.0 for SDGE3010. Program level verification rates for therms ranged from a low of 0.96 for SCG3513 to 1.0 for SDGE3010.
3. Unit savings for SCE2517 Express Efficiency – for 80 percent of the Express Efficiency measures (80%) that were included in the sample, the verification unit savings value differed from the ex ante unit savings value. The difference ranged across measures from a 31% increase in the savings from the verification to an 83% decrease in savings. In all cases the differences were caused by either the assignment of the wrong ID (DEER or work paper) or the assignment of the wrong unit savings for a correct ID. A discussion with SCE about these results indicated that the wrong assignments were due to a problem with the IOU tracking database, which is being corrected.

APPENDIX A: ON-SITE DATA COLLECTION

A verification data collection form was completed for each measure, as described in Section 4.4. The verification data collection form had three sections. The top section was completed by the lead analyst prior to the site visit. It contains information available from the tracking database, application file and the recruitment form. The middle section was completed during the on-site survey based on observations made in the field and information provided by the customer (through the site contact). The bottom section was completed after the on-site survey was completed. Each of these sections is described in more detail below.

Completed Before Site Visit (All Sites)

Prior to the site visit, the lead analyst conducted a detailed review of the application file. The analyst reviewed relevant cut sheets and measure specifications provided in the file to gain a thorough understanding of the physical and operation characteristics of the sampled measure and the need for supplemental data to support the review of the ex ante estimate.

The top of the data collection form was completed using data from the tracking database, application file and recruitment form. Discrepancies between these three data sources were resolved prior to or during the site visit after consultation with the SBW Project Manager.

The following information was entered for all measures:

Program – The IOU incentive program associated with the measure (SCE2517, SCG3513, SGDGE3010 or SDGE3025)

Project ID – The IOU assigned project number

SBW Measure ID – The identification number assigned to the measure by SBW.

Program Year - The program year in which the incentive was paid. Entries could include 2006, or 2007.

Install Date - The date that the measure was installed by the customer, as documented in the application files and/or the IOU tracking database. The install dates were 2006 or 2007.

Measure Cost (if available) - The full installed measure cost, as documented in the application file or the IOU tracking database. This include labor, materials and other costs (e.g., cost of preparing the application) allowed by the programs.

Total Annual Savings - The total annual energy and demand savings (kW and kWh or therms) that were claimed by the IOU for the sampled measure, as documented in the IOU tracking database and the application file.

Analysis Units - The units of analysis used by the IOUs as the basis for the installed quantities. Examples include lighting fixtures, lamps or motors. These were documented in the IOU tracking database and/or in the application file.

Unit Quantity - The installed quantity documented by the IOUs in the tracking database and/or the application file. For many measures this was a single number. In some cases (where supported by tracking database or application file data) it included an itemization of the total count by equipment size or other factor to simplify the site observations.

Measure Description - A brief description of the measure, as documented in the application file and/or the IOU tracking database.

Work paper ID - The identifier of the work paper used to estimate measure savings, as documented in the IOU tracking database.

Site name - The name of the site where the measure was installed as shown in the tracking database and/or application file. The on-site survey will be performed at this site.

Site Address City and Zip - The address for the site where the measure was installed. The site inspection occurred at this address.

Site Contact - The name of the person at the site that was contacted to schedule the site inspection. This person was familiar with the installed measure, its location at the site and its operating performance.

Phone - The telephone number for the site contact during business hours.

E-mail - The business e-mail for the site contact.

Completed Before Site Visit (DEER Only)

The following additional information was entered for DEER measures, as documented in the DEER database and the IOU tracking database:

DEER Run ID - A unique identifier assigned to a measure in the IOU tracking database.

DEER Measure ID - A unique identifier assigned to a measure in the IOU tracking database.

Annual Unit Savings - The annual unit energy and demand savings assigned in the IOU tracking database for the sampled measure, expressed as kWh and kW or therms.

Vintage Code - One of the possible DEER vintage codes, as documented in the DEER Run ID.

Vintage Description - A description of the selected vintage code.

Building Code - One of the possible building codes, as documented in the DEER Run ID.

Building Description - A description of the selected business code.

Climate Zone - One of the possible climate zone options, as documented in the DEER Run ID.

Fuel Code - One of the three fuel type options in DEER; electricity, gas or both electricity and natural gas.

Completed During Site Visit (DEER and work paper)

The following information was collected during the site visit for DEER and work paper measures:

Vintage Code - If the vintage code was verified to be correct, the “verified” entry was selected. If one of the other vintage codes was more appropriate, then it was selected.

Building Code - If the building code was verified to be correct, the “verified” entry was selected. If one of the other business codes was more appropriate, then it was selected.

Climate Code - If the climate code was verified to be correct, the “verified” entry was selected. If one of the other climate codes was more appropriate, then it was selected.

Fuel Code - If the fuel code was verified to be correct, the “verified” entry was selected. If one of the other fuel codes was more appropriate, then it was selected.

Completed During Site Visit (Screw-in CFL Only)

When CFLs are encountered, additional data collection was required to support a calculation of CFL installation rate. Some or all of this information was collected in the field, if it was not collected during recruitment. The additional data collected included:

Units/% purchased at retailers - The number of installed CFLs that were purchased from a retailer, per discussions with facility during the site visit. Expressed as a count or a % of the measure total count.

Units/% received from giveaways - The number of installed CFLs that were received from a giveaway program, per discussions with facility during the site visit. Expressed as a count or a % of the measure total count.

Units/% put in storage - The number of CFLs that were purchased or received during measure implementation but were stored for future use rather than installed, per discussions with facility during the site visit. Expressed as a count or a % of the measure total count.

Completed During Site Visit (All Sites)

During field data collection, the following entries were made for all measures:

Inspector Initials - The initials for the field staff who performed the on-site survey.

Inspection Date - The date that the on-site survey was performed.

Measure Cost - To the extent possible, the measure cost was confirmed while on site through the review of an invoice or discussions with facilities staff. If the project cost entered at the top of the form (from the project tracking database or application file) was not correct, a more appropriate value was entered.

Installation Date - While on-site, the installation date noted in the application file was confirmed by interviewing the site contact or examining information available on site that can confirm this date.

Photo Taken - When allowed by customer security procedures, at least one photo was taken for each measure to further document the measure installation. The inspector could take additional photos to support the review of the ex ante savings estimates, the current operational status or other important information.

The form provided several lines for documentation of the measure quantities observed in the field. For some measures the quantity was documented in a single line. For others, multiple lines were used to adequately distinguish quantities by variations in equipment size and location. Multiple forms were used, if additional lines were needed.

Description - This entry documented the distinguishing feature of the measure that was accounted for on each line. Differences in equipment size, such as motor horsepower or the length or number of lamps per fixture were most frequently the distinguishing feature. Location in the facility was also a distinguishing feature.

Location - A brief description of the location within the facility of the equipment associated with the equipment description.

Unit Quantity Installed - The quantity of installed units (for each line) found during the site visit. The quantity was with respect to the Analysis Units described below. A note was made in the comments column, if the installation status information was not directly observed because of security limitations or other reasons. This quantity was compared to the “unit quantity from the file” entry at the top of the form. A unit was counted as installed, whether or not it was eligible or operational. The ‘unit quantity’ value was entered, if the field verified count was within $\pm 5\%$ of the file value for measures with large counts.

When measure sampling was required, this quantity was the extrapolated value. If significant sampling was required, an additional “Site Sampling” worksheet was added to the workbook to document the raw counts and sampling methodology, limited to the sampled cases.

Unit Quantity Eligible - The quantity of observed units (for each line) that was eligible for the incentive, per program rules. The quantity was with respect to the Analysis Units described below. The eligibility criteria for each measure were provided in the site workbook. The eligible quantity should be equal to or less than the unit quantity installed.

Unit Quantity Eligible and Operational - The quantity of units found during the site visit that were both eligible and operational. If the equipment was not operating during the site visit but was confirmed to be capable of operating and saving energy, it was considered to be operational. Equipment that was broken or incapacitated during the site visit was not considered to be operational because it was not capable of saving energy in its current state. Inquiries from the site contact about the operational status were made if it could not be directly observed. A note was made in the last column if the operational status information was not directly observed.

Analysis Units - The units of analysis used as the basis for the eligible, installed and eligible/operational quantities. Whenever possible, these units were the same as the units entered at the top of the form. A change to the analysis units was acceptable if the analysis units were not

specified in the application file or tracking database or if the units specified by the IOU were not directly observable (e.g., kWh or therms).

O/S - An “O” was entered, if the information on the line was directly observed. An “S” was entered, if the information was sampled.

Quality (1–5) - After the measure was inspected, a quality rating was entered from the following choices:

1 = unacceptable quality

2 = poor quality

3 = acceptable quality

4 = very good quality

5 = excellent quality

If the quality rating was either 1 (unacceptable) or 2 (poor), observations and reasons for assigning this rating under ‘quality comments’ were entered at the end of the form.

Comments - Information in the comments column was optional, if there was no measure sampling and there were no discrepancies between the project tracking data/application file and what was found during the site visit. For cases where discrepancies were found, this column documented observations that were useful in analyzing the site survey data, such as explaining the reasons for differences between field observations and the IOU tracking database/application file. For cases where measure sampling was required, this column documented the sampling that was done at each location and information that was helpful to the sample extrapolation. Additional comments and the methodology for sample extrapolation were sometimes also written in the “Additional Notes” and “sampling comments” section at the end of the form.

Completed During Site Visit (Supplemental Information)

This portion of the data collection form was used by the lead analyst to document additional information that would assist with the review of the ex ante savings estimate. An initial review of the ex ante estimate occurred prior to the site visit. At that time, the lead analyst determined the additional information during the site visit that was referenced in the work paper or was otherwise useful to the ex ante savings review. The lead analyst listed on the form the parameters that were desired from observations or from the site contact. Examples of supplemental data that were specified included manufacturer and model number of the installed equipment; the annual operations schedule for the affected equipment; the affected floor area or other measure performance specifications that needed to be verified at the site.

Completed After Site Visit (All Sites)

As soon as possible after the field data was collected, the lead analyst analyzed the data collected in the field and compared it to the program data from the IOU database or application file. The lead analyst compared the value for “unit quantity from file” at the top of the form to the total “unit quantity installed” value documented in the field. Similar comparisons were made for “unit quantity eligible” and “unit

quantity eligible and operational”. When measure sampling was required, the lead analyst extrapolated from the observed sample to the measure population before this comparison was made. The extrapolation method was documented on the site sampling sheet in the site workbook.

If significant differences were noted, they were documented on the form as follows:

Reasons for Quantity Difference - If the “unit quantity from file” value at the top of the form is significantly different from the total “unit quantity installed” value documented in the field, the reasons for this difference were documented to the extent that they were known from information collected in the field. In addition, if the total “unit quantity eligible” and “unit quantity eligible and operational” values were significantly different from the total “unit quantity installed” value, the reasons were documented on the form to the extent that they were known. Reasons for these differences were typically documented in the comments column, above, or in the additional notes section at the end of the form.

Completed After Site Visit (DEER only)

After returning from the field, the lead analyst or other member of the verification team verified the DEER Run ID and Measure ID in the IOU tracking database and documented at the top of the form. The verification was based on field observations and other data collected during the site visit. The lead analyst located the installed measure in the DEER database under the IOU assigned ID and compared the following measure attributes to the values observed in the field and documented on this form:

- Vintage
- Climate zone
- Fuel type
- Building Type

If differences were noted for any of these parameters, they were documented at the end of the form and the correct Run ID or Measure ID was assigned and documented. If the differences in attributes resulted in a different DEER savings value, the revised savings were documented at the end of the form.

Completed After Site Visit (Cost Difference)

After returning from the field, the lead analyst also compared the value for measure cost at the top of the form to the measure cost value documented in the field. If a significant difference was found, the reasons for the difference were documented on the form to the extent that they were known from data provided by facility staff.

Completed After Site Visit (Notes)

The “Additional Notes” and “Sampling Notes” sections were sometimes used by the field inspector or lead analyst to clarify the information entered above. The “Quality Comments” section was used to document reasons for assigning a Quality Code of “poor” or “unacceptable” to the observed equipment.

Version 5 (Feb 13, 2008)

Verification Data Collection Form

SBW Rep:

Completed before site visit

Page: of

| | |
|---|------------------------|
| All Sites (from file or tracking database) | |
| Program: | Project ID: |
| Measure Cost: | SBW Measure ID: |
| Analysis Units: | Annual Energy Savings: |
| Measure Description: | Unit Qty.: |
| Site Name: | Work Paper ID: |
| Site Contact: | Install Date: |
| | kWh |
| | Annual Demand Savings: |
| | kW |
| | City: |
| | ZIP: |
| | Address: |
| | Phone: |
| | Email: |
| DEER only (from file or tracking database) | |
| DEER Run ID: | DEER Measure ID: |
| Vintage Code: | Annual Unit Savings: |
| Building Code: | kWh |
| | kW |
| | Climate Code: |
| | Fuel Code: |
| | Therms |

Completed during site visit

| | | | | | | | |
|--|---|------------------|------------------|------------------|------------------|------------------|------------------|
| DEER and Work Paper | | | | | | | |
| Vintage Code: | <table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="padding: 2px;">03 02 thru 05</td> <td style="padding: 2px;">05 ≥ 06</td> <td style="padding: 2px;">75 < 78</td> <td style="padding: 2px;">85 78 thru 92</td> <td style="padding: 2px;">96 93 thru 01</td> <td style="padding: 2px;">AV No Vintage</td> </tr> </table> | 03 02 thru 05 | 05 ≥ 06 | 75 < 78 | 85 78 thru 92 | 96 93 thru 01 | AV No Vintage |
| 03 02 thru 05 | 05 ≥ 06 | 75 < 78 | 85 78 thru 92 | 96 93 thru 01 | AV No Vintage | | |
| Building Code: Verified | Climate Code: Verified | | | | | | |
| Fuel Code: Verified | | | | | | | |
| Screw-in CFL only | | | | | | | |
| Units / % purchased at retailers: | Units / % received from give aways: | | | | | | |
| Units / % put in storage: | | | | | | | |
| All Sites | | | | | | | |
| Inspector Initials: | Inspection date: | | | | | | |
| Measure Cost: Verified | Install Date: Verified | | | | | | |
| Photo taken: | | | | | | | |
| Unit Quantity | | | | | | | |
| Description (incl. size): | Location | | | | | | |
| Installed | Eligible | | | | | | |
| Eligible & Operational | Analysis Units | | | | | | |
| O/S | Qual. (1-5) | | | | | | |
| Comments | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
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| | | | | | | | |
| | | | | | | | |
| Unit Quantity Totals | | | | | | | |
| (continue on supplemental form) | | | | | | | |
| Supplemental data to be collected to support review of ex ante savings estimate (Ex. Floor area, operations schedule, make/model number, change in specs) | | | | | | | |
| O/S = Observed / Sampled DK = Don't Know NA = Not Applicable Quality Scale: 1=Unacceptable 2=Poor 3=Acceptable 4=Very Good 5=Excellent | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| (continue on back) | | | | | | | |

Completed during or after site visit

All Sites

Reasons for quantity difference:

Installed: _____

Eligible: _____

'Eligible and Operational: _____

DEER and Work PaperRun ID or Work Paper ID verified: No (If No, revise ID and reasons for differences) Revised ID:
Work paper run ID in data base incompleteMeasure ID verified (DEER only): (If No, revise ID and reasons for differences) Revised ID: Annual savings verified: No (If No, revise savings and reasons for differences) Revised savings:

Reasons for cost difference: _____

Additional Notes: _____

Sampling Notes: _____

Quality Comments:(if 1 or 2) _____

APPENDIX B

Program: SCE2517kWh

| Measure ID | Measure Description | | Measure Group | Savings (ex ante) | | | Verification Rate | | | Reason Rate < 1 |
|------------|---|-----|-----------------------|-------------------|-------|--------|-------------------|-------------|--------|---|
| | IOU | SBW | | kW | kWh | therms | kW | kWh | therms | |
| M00021 | High Efficiency Exit Sign - LED | | C&I Interior lighting | 0 | 4047 | 0 | 0.781201471 | 0.781 | | "Incorrect value taken from DEER; Expected number of units not installed; Some units not operational" |
| M00022 | High Efficiency Exit Sign - LED | | C&I Interior lighting | 0 | 3513 | 0 | 0.7 | 0.700 | | Some units not operational |
| M00023 | T-8 or T-5 Lamp and Electronic, 4-foot lamp installed | | C&I Interior lighting | 1 | 6918 | 0 | 1.121495327 | 0.665 | | Incorrect value taken from Work paper |
| M00024 | T-8 or T-5 Lamp and Electronic, 4-foot lamp installed | | C&I Interior lighting | 1 | 4235 | 0 | 0 | 0.000 | | Installed units have been replaced |
| M00025 | INTERIOR HIGH BAY FIX 400W BC UP TO 244W RPLCMT | | C&I Interior lighting | 2 | 6153 | 0 | 1 | 1.000 | | 0 |
| M00026 | T-8 or T-5 Lamp and Electronic, 8-foot lamp removed | | C&I Interior lighting | 4 | 19897 | 0 | 1.182481752 | 0.702906529 | | |
| M00027 | T-8 or T-5 Lamp and Electronic, 4-foot lamp installed | | C&I Interior lighting | 2 | 4331 | 0 | 0.666666667 | 1.312 | | Incorrect value taken from Work paper |
| M00028 | T-8 or T-5 Lamp and Electronic, 4-foot lamp installed | | C&I Interior lighting | 1 | 5197 | 0 | 1.059311339 | 0.736 | | Incorrect value taken from Work paper |
| M00029 | INTERIOR HIGH BAY FIX 400W | | C&I Interior lighting | 5 | 24633 | 0 | 1 | 1.000 | | 0 |

| Measure Description | | | Savings (ex ante) | | | Verification Rate | | |
|-------------------------|---|-----------------------|-------------------|--------|---|-------------------|-------------|---|
| BC UP TO 244W RPLCMT | | | | | | | | |
| M00030 | Strip Curtains | C&I Refrigeration | 1 | 18054 | 0 | 1 | 1.000 | 0 |
| M00037 | Injection Molding Machine Replacement | C&I Process | 8 | 47755 | 0 | 1 | 1.000 | 0 |
| M00038 | Vacuum Pumps VSD | C&I Mtr controls | 8 | 114398 | 0 | 1 | 1.000 | 0 |
| M00039 | T-8 or T-5 Lamp and Electronic, 4-foot lamp installed | C&I Interior lighting | 8 | 37922 | 0 | 1.168229495 | 0.692 | Incorrect value taken from Work paper |
| M00040 | INTERIOR LINEAR FLUORESCENT FIXTURE 400W LAMP BASECASE, UP TO 244W RPL FIXTURE (TIER 1) | C&I Interior lighting | 18 | 48987 | 0 | 0.842191333 | 1.005 | Incorrect Work paper selected |
| M00041 | T-8 or T-5 Lamp and Electronic, 8-foot lamp removed | C&I Interior lighting | 9 | 41571 | 0 | 1.19989181 | 1.089188495 | |
| M00042 | INTERIOR LINEAR FLUORESCENT FIXTURE 400W LAMP BASECASE, UP TO 244W RPL FIXTURE (TIER 1) | C&I Interior lighting | 11 | 61143 | 0 | 0.765 | 0.734 | "Incorrect Work paper selected; Expected number of units not installed" |
| M00043 | PRINCE CASTLE DBH4SS-20 UNIT (24 HR OPERATION) | C&I Other | 4 | 42040 | 0 | 1 | 1 | |

| Measure Description | | | Savings (ex ante) | | | Verification Rate | | |
|---------------------|---|-----------------------|-------------------|--------|---|-------------------|-------------|--------------------------------|
| M00044 | T-8 or T-5 Lamp and Electronic, 4-foot lamp installed | C&I Interior lighting | 10 | 56099 | 0 | 1.288 | 0.777 | |
| M00052 | Glass Door Cooler/Freezer Gaskets | C&I Refrigeration | 19 | 170058 | 0 | 0.335076165 | 0.199266699 | |
| M00053 | Lighting - Indoor System Replacement Fluorescent | C&I Interior lighting | 37 | 176570 | 0 | 0.990628661 | 0.990628661 | |
| M00054 | Variable Frequency Drives for HVAC Fans | C&I Mtr controls | 29 | 171965 | 0 | 1.047653257 | 0.880 | Incorrect DEER Run ID selected |
| M00055 | Variable Frequency Drives for HVAC Fans | C&I Mtr controls | 47 | 276372 | 0 | 0.931034483 | 1.000 | 0 |
| M00056 | T-8 or T-5 Lamp and Electronic, 4-foot lamp removed | C&I Interior lighting | 37 | 121339 | 0 | 1.041666221 | 1.042 | Incorrect DEER Run ID selected |
| M00057 | Lighting - Indoor System Replacement Fluorescent | C&I Interior lighting | 27 | 152207 | 0 | 1 | 1 | 0 |
| M00058 | SA-Injection Molding Machine New Load | C&I Process | 25 | 185211 | 0 | 1 | 1 | |
| M00065 | INTERIOR LINEAR FLUORESCENT FIXTURE 400W LAMP BASECASE, UP TO 244W RPL FIXTURE (TIER 1) | C&I Interior lighting | 98 | 575659 | 0 | 0.819931565 | 0.760 | Incorrect Work paper selected |
| M00066 | Lighting - Indoor | C&I Interior lighting | 133 | 749280 | 0 | 1 | 1.000 | 0 |

| Measure Description | | | Savings (ex ante) | | | Verification Rate | | | |
|---------------------|---|--|-------------------|---------|---------|-------------------|-------------|-------|---|
| | System Modification Fluorescent | | | | | | | | |
| M00067 | Variable Speed Drives | C&I Mtr controls | 0 | 401540 | 0 | 1 | 1.000 | 0 | |
| M00068 | Lighting - Indoor System Replacement HID | C&I Interior lighting | 69 | 345237 | 0 | 1 | 1 | | |
| M00069 | Lighting - Indoor System Replacement Fluorescent | C&I Interior lighting | 38 | 547530 | 0 | 0.901287554 | 0.901287554 | | |
| M00070 | Pumping System Controls | C&I Mtr controls | 41 | 341340 | 0 | 1 | 1 | | |
| M00071 | Lighting - Indoor System Modification Fluorescent | C&I Interior lighting | 89 | 519425 | 0 | 0.970588235 | 0.970588235 | | |
| M00078 | Equipment | Retrofit and right-sizing of submersible pumps | C&I Other | 167 | 1463736 | 0 | 1 | 1.000 | 0 |
| M00079 | Injection Molding Machine Replacement | C&I Process | 276 | 1264358 | 0 | 1 | 1.000 | | |
| M00080 | Variable Speed Drives | C&I Mtr controls | 170 | 1282809 | 0 | 1 | 1.000 | 0 | |
| M00081 | Lighting - Indoor System Modification Fluorescent | C&I Interior lighting | 250 | 1932123 | 0 | 1 | 1.000 | 0 | |
| M00082 | Lighting - Indoor System Replacement Fluorescent | C&I Interior lighting | 167 | 1206280 | 0 | 1 | 1 | | |

| Measure Description | | | | Savings (ex ante) | | | Verification Rate | | |
|---------------------|--|--|-----------------------|-------------------|----------|---|-------------------|-------|---|
| M00083 | Lighting - Indoor System Replacement Fluorescent | | C&I Interior lighting | 156 | 1168578 | 0 | 1 | 1.000 | 0 |
| M00089 | Equipment | Cement plant roll mill replacement | C&I Other | 2850 | 33918700 | 0 | 1 | 1.000 | 0 |
| M00090 | Wastewater Retro-Commissioning | | C&I Other | 298 | 2613984 | 0 | 1.000 | 1.000 | |
| M00091 | Pumping System Controls | | C&I Mtr controls | 313 | 3751945 | 0 | 1 | 1.000 | 0 |
| M00092 | Adjustable Speed Drives- Water Services | | C&I Mtr controls | 0 | 4078005 | 0 | 1 | 1 | |
| M00093 | Equipment | Bottle blowing high pressure air recovery | C&I Other | 444 | 3068403 | 0 | 1 | 1.000 | 0 |
| M00094 | Injection Molding Machine Replacement | | C&I Process | 463 | 5002779 | 0 | 1 | 1 | |
| M00095 | Pumping System Controls | Retrofit and right-sizing of submersible pumps | C&I Mtr controls | 526 | 4607877 | 0 | 1 | 1 | |
| M00096 | Air Compressor System | | C&I Process | 369 | 3760506 | 0 | 1 | 1.000 | 0 |
| M00097 | Equipment | Production line redesign | C&I Other | 1121 | 4718839 | 0 | 1 | 1 | |

Program: SCG3513kWh

| SCG3513kWh | Measure Description | Measure Group | Savings (ex ante) | Verification Rate | Reason Rate < 1 |
|------------|---------------------|---------------|-------------------|-------------------|-----------------|
|------------|---------------------|---------------|-------------------|-------------------|-----------------|

| | IOU | SBW | | kW | kWh | therms | kW | kWh | therms |
|--------|----------------------|---|-----------|----|-----|--------|----|-----|-----------------------------|
| M00098 | Heat Recovery | Boiler upgrade to condensing boiler | C&I Other | 0 | 0 | 22,282 | | | 1 |
| M00099 | Equip. Modernization | Garment dyeing machine replacement | C&I Other | 0 | 0 | 22,197 | | | 1 |
| M00100 | Equip. Modernization | Boiler and piping insulation | C&I Other | 0 | 0 | 18,861 | | | 1 |
| M00101 | Heat Recovery | Heat exchanger to heat tostada fryer oil | C&I Other | 0 | 0 | 40,680 | | | 1 |
| M00102 | Heat Recovery | Laundry hot water heat recovery | C&I Other | 0 | 0 | 27,591 | | | 1 |
| M00103 | Equip. Modernization | Standing pilot burners replaced w/electronic | C&I Other | 0 | 0 | 12,055 | | | 1 |
| M00104 | Equip. Modernization | Replacement burners and controls on ovens | C&I Other | 0 | 0 | 19,201 | | | 1 |
| M00105 | Equip. Modernization | Milk pasteurizer heat exchanger | C&I Other | 0 | 0 | 32,730 | | | 1 |
| M00106 | Heat Recovery | Condensing heat exchangers on space-heating boilers | C&I Other | 0 | 0 | 10,147 | | | 1 |
| M00107 | Heat Recovery | Boiler preheat | C&I Other | 0 | 0 | 55,491 | | | 0 |
| | | | | | | | | | Customer switched utilities |

| SCG3513kWh Measure ID | Measure Description | | Measure Group | Savings (ex ante) | | | Verification Rate | | | Reason Rate < 1 |
|--------------------------|----------------------|--|---------------|-------------------|-----|---------|-------------------|-----|--------|--|
| | IOU | SBW | | kW | kWh | therms | kW | kWh | therms | |
| | | heat exchanger | | | | | | | | |
| M00113 | GPM | Regenerative Oxidizer Installation | C&I Other | 0 | 0 | 186,366 | | | 1 | |
| M00114 | Equip. Modernization | Water tube boiler rebuild | C&I Other | 0 | 0 | 165,346 | | | 1 | |
| M00115 | Heat Recovery | Laundry hot water and flue gas heat recovery | C&I Other | 0 | 0 | 119,950 | | | 1 | |
| M00116 | Equip. Modernization | Reverse osmosis system | C&I Other | 0 | 0 | 110,839 | | | 1 | |
| M00117 | Equip. Modernization | Laundry washer replacement w/tunnel washer | C&I Other | 0 | 0 | 82,149 | | | 1 | |
| M00118 | Heat Recovery | Heat exchanger efficiency improvement | C&I Other | 0 | 0 | 151,370 | | | 1 | |
| M00119 | GPM | Regenerative Oxidizer Installation | C&I Other | 0 | 0 | 145,381 | | | 1 | |
| M00120 | GPM | New textile tubular double pass dryer | C&I Other | 0 | 0 | 246,966 | | | 1 | |
| M00121 | Equip. Modernization | Boiler and piping insulation | C&I Other | 0 | 0 | 100,476 | | | 0.884 | Expected number of units not installed |
| M00125 | GPM | Thermal Oxidizer | C&I Other | 0 | 0 | 445,160 | | | 1 | |

| SCG3513kWh Measure ID | Measure Description | | Measure Group | Savings (ex ante) | | | Verification Rate | | | Reason Rate < 1 |
|--------------------------|----------------------|---|---------------|-------------------|-----|-----------|-------------------|-----|--------|-----------------|
| | IOU | SBW | | kW | kWh | therms | kW | kWh | therms | |
| | | Replacement (with new regenerative ones) | | | | | | | | |
| M00126 | GPM | Efficient 3- stage juice evaporator | C&I Other | 0 | 0 | 1,227,824 | | | 1 | |
| M00127 | GPM | Insulation of tanks, pipes, and HXs | C&I Other | 0 | 0 | 2,053,844 | | | 1 | |
| M00128 | GPM | Boiler to Drier Heat Recovery | C&I Other | 0 | 0 | 286,680 | | | 1 | |
| M00129 | GPM | Steam Boiler replacement | C&I Other | 0 | 0 | 487,584 | | | 1 | |
| M00130 | Equip. Modernization | Burner replacement on asphalt aggregate dryer | C&I Other | 0 | 0 | 339,670 | | | 1 | |

Program: SDGE3010kWh

| SDGE3010kWh Measure ID | Measure Description | | Measure Group | Savings (ex ante) | | | Verification Rate | | | Reason Rate < 1 |
|---------------------------|------------------------------------|-----|-----------------------|-------------------|-----------|--------|-------------------|-----|--------|-----------------|
| | IOU | SBW | | kW | kWh | therms | kW | kWh | therms | |
| M00131 | 2 Lamp T8 Fixtures | | C&I Interior lighting | 3.47 | 10,820.00 | 0.00 | 1 | 1 | | |
| M00132 | Tower VFD | | C&I HVAC Controls | 0 | 29,629.00 | 0.00 | 1 | 1 | | |
| M00133 | 6 Lamp T8 (Gym) | | C&I Interior lighting | 1.96 | 15,382.00 | 0.00 | 1 | 1 | | |
| M00134 | 4 Lamp GE Low Power T8 Fixtures | | C&I Interior lighting | 3.97 | 20,226.00 | 0.00 | 1 | 1 | | |

| SDGE3010kWh Measure ID | Measure Description | | Measure Group | Savings (ex ante) | | | Verification Rate | | | Reason Rate < 1 |
|---------------------------|--|-----|-----------------------|-------------------|--------------|-----------|-------------------|-------|--------|--|
| | IOU | SBW | | kW | kWh | therms | kW | kWh | therms | |
| M00135 | 2 Lamp Normal Power T8 Fixtures | | C&I Interior lighting | 12.57 | 62,737.00 | 0.00 | 1 | 1 | | |
| M00142 | CO Sensors | | C&I HVAC Controls | 9.04 | 174,606.00 | 0.00 | 1 | 1 | | |
| M00143 | CO System | | C&I HVAC Controls | 27.49 | 262,936.00 | 0.00 | 1 | 1 | | |
| M00144 | CO System | | C&I HVAC Controls | 6.81 | 131,468.00 | 0.00 | 1 | 1 | | |
| M00145 | CO Sensor | | C&I HVAC Controls | 13.78 | 266,066.00 | 0.00 | 1 | 1 | | |
| M00146 | 6 Lamp T8 High Output | | C&I Interior lighting | 21.7 | 94,663.00 | 0.00 | 1 | 1 | | |
| M00147 | 6 Lamp T8 High Output | | C&I Interior lighting | 25.3 | 110,441.00 | 0.00 | 1 | 1 | | |
| M00154 | CO System | | C&I HVAC Controls | 27.92 | 539,019.00 | 0.00 | 1 | 1 | | |
| M00155 | 4 Lamp T5 High Output | | C&I Interior lighting | 89.6 | 373,838.00 | 0.00 | 1 | 1 | | |
| M00156 | CO System | | C&I HVAC Controls | 68.78 | 657,340.00 | 0.00 | 1 | 1 | | |
| M00157 | CO Systems | | C&I HVAC Controls | 21.35 | 412,070.00 | 0.00 | 1 | 1 | | |
| M00158 | T8 Fluorescent retrofit | | C&I Interior lighting | 100.4 | 592,703.00 | 0.00 | 1 | 1 | | |
| M00164 | Air Handler Upgrades for 5 units on Women's Center | | C&I Other | 83.9 | 734,549.00 | 21,232.00 | 1 | 1 | 1 | |
| M00165 | Chiller Replacement | | C&I Cooling | 133.3 | 1,020,659.00 | 0.00 | 1 | 1 | | |
| M00166 | 4L4' TO 28W/ELEE LO/NEW-8' | | C&I Interior lighting | 153.419 | 1,174,422.00 | 0.00 | 0.992 | 0.992 | | Some lamps burnt out |
| M00167 | CO Sensors | | C&I HVAC Controls | 95.35 | 1,840,552.00 | 0.00 | 1 | 1 | | |
| M00168 | CO System | | C&I HVAC Controls | 116.83 | 1,117,478.00 | 0.00 | 1 | 1 | | |
| M00169 | UV Lighting to Chemical Disinfection | | C&I Other | 72.34 | 782,472.00 | 0.00 | 1 | 1 | | |
| M00174 | CO Systems for Parking Garages | | C&I HVAC Controls | 125.84 | 2,429,300.00 | 0.00 | 0.958 | 0.958 | | Database savings value does not match application file value |

| SDGE3010kWh Measure ID | Measure Description | | Measure Group | Savings (ex ante) | | | Verification Rate | | | Reason Rate < 1 |
|---------------------------|---------------------|-----|-------------------|-------------------|--------------|------------|-------------------|-----|--------|-----------------|
| | IOU | SBW | | kW | kWh | therms | kW | kWh | therms | |
| M00175 | Lab Controls | | C&I Other | 224.3 | 1,965,560.00 | 100,462.00 | 1 | 1 | 1 | |
| M00176 | CO System | | C&I HVAC Controls | 280.39 | 5,412,785.00 | 0.00 | 1 | 1 | | |

Program: SDGE3010therm

| SDGE3010therm Measure ID | Measure Description | | Measure Group | Savings (ex ante) | | | Verification Rate | | | Reason Rate < 1 |
|-----------------------------|--|--------------------|---------------|-------------------|--------------|------------|-------------------|-----|--------|-----------------|
| | IOU | SBW | | kW | kWh | therms | kW | kWh | therms | |
| M00177 | Re-Commission_F | Air flow reduction | C&I Other | 16 | 135,554.00 | 6,928.00 | 1 | 1 | 1 | |
| M00178 | Central Plant, air handlers, EMS, Hartman LOOP & T | | C&I Other | 100 | 1,219,564.00 | 15,355.00 | 1 | 1 | 1 | |
| M00181 | Lab Controls | | C&I Other | 224 | 1,965,560.00 | 100,462.00 | 1 | 1 | 1 | |
| M00182 | Stills Overhead Vapor Cross Feed Heat Exchangers | | C&I Other | 0 | 0.00 | 851,052.00 | | | 1 | |
| M00183 | Air Handler Conversion to VT-VAV | | C&I Other | 43 | 652,068.00 | 69,326.00 | 1 | 1 | 1 | |

Program: SDGE3025kWh

| SDGE3025kWh Measure ID | Measure Description | | Measure Group | Savings (ex ante) | | | Verification Rate | | | Reason Rate < 1 |
|---------------------------|-------------------------|-----|-----------------------|-------------------|-----------|--------|-------------------|-----|--------|-----------------|
| | IOU | SBW | | kW | kWh | therms | kW | kWh | therms | |
| M00184 | Command Center Fan Coil | | C&I Cooling | 0 | 52,665.00 | 0 | 1.0 | 1.0 | | |
| M00185 | Lighting Retrofit | | C&I Interior lighting | 18 | 53,153.00 | 0 | 1.0 | 1.0 | | |

| SDGE3025kWh Measure ID | Measure Description | | Measure Group | Savings (ex ante) | | | Verification Rate | | | Reason Rate > 1 |
|---------------------------|--|-----|-----------------------|-------------------|------------|--------|-------------------|-------|--------|--|
| | IOU | SBW | | kW | kWh | therms | kW | kWh | therms | |
| M00186 | Lighting Retrofit | | C&I Interior lighting | 7 | 30,067.00 | 0 | 1.0 | 1.0 | | |
| M00187 | Lighting Retrofit | | C&I Interior lighting | 11 | 55,900.00 | 0 | 0.872 | 0.872 | | Expected number of units not installed |
| M00191 | Lighting Retrofit | | C&I Interior lighting | 22 | 125,445.00 | 0 | 1.0 | 1.0 | | |
| M00192 | Central Plant Chiller Replacement | | C&I Cooling | 25 | 126,266.00 | 0 | 1.0 | 1.0 | | |
| M00193 | Lighting Retrofit | | C&I Interior lighting | 41 | 160,043.00 | 0 | 0.706 | 0.706 | | Expected number of units not installed |
| M00197 | Replace compressor on chiller with 3 new compresso | | C&I Cooling | 76 | 414,968.00 | 0 | 1.0 | 1.0 | | |
| M00198 | Lighting Reduction | | C&I Interior lighting | 72 | 312,673.00 | 0 | 0.957 | 0.957 | | Minor differences in quantity |
| M00199 | Lighting Retrofit | | C&I Interior lighting | 44 | 292,120.00 | 0 | 1.0 | 1.0 | | |
| M00200 | High Efficiency Packaged A/C or Chiller 600 Tons | | C&I Cooling | 0 | 258,048.00 | 0 | 1.0 | 1.0 | | |
| M00204 | 1- 365 ton Chiller Replacement | | C&I Cooling | 120 | 548,371.00 | 0 | 1.0 | 1.0 | | |
| M00205 | High-Efficiency Package Chillers | | C&I Cooling | 69 | 513,683.00 | 0 | 1.0 | 1.0 | | |
| M00206 | Chiller Replacement | | C&I Cooling | 56 | 516,636.00 | 0 | 1.0 | 1.0 | | |

